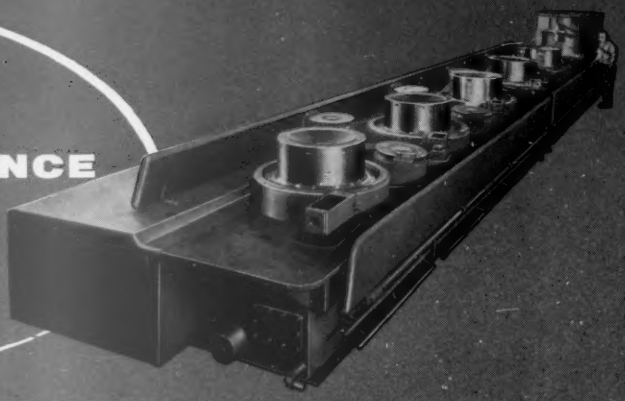
WIRE AND WIRE PRODUCTS

SEPTEMBER, 1958

VAUGHN®

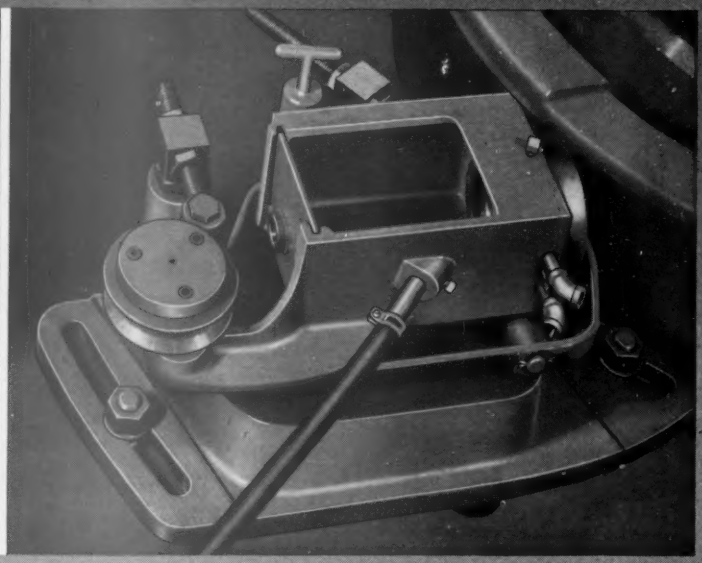
MOTOBLOX® PERFORMANCE

is built by features like this



WET OR DRY CASTING DIE-HOLDER

Standard on all VAUGHN MOTOBLOX



One of the many refinements found on VAUGHN MOTOBLOX is this Die-Holder for wet or dry lubricant. Its universal adjustment for casting; built-in, water-cooled, bronze die adapter; and guide sheave for taking bow out of wire make it truly a deluxe feature—yet *standard equipment* on your Motoblox. ● Do you have the complete Vaughn Catalog? Free on request.

The VAUGHN Machinery Company

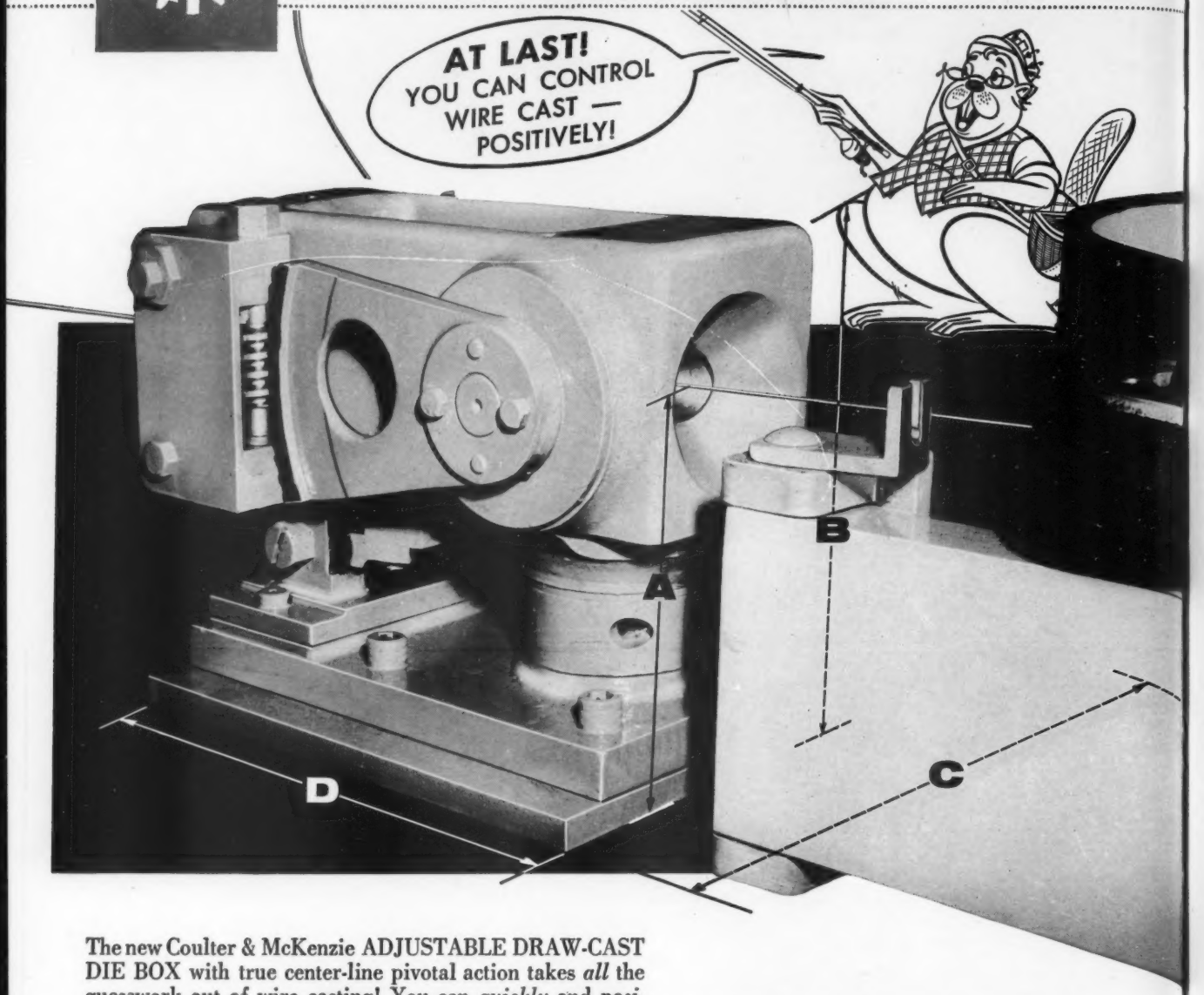
Cuyahoga Falls, Ohio, U. S. A.

COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys

"Quick on the Draw!"

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

ADJUSTABLE DRAW-CAST DIE BOX
FOR WET OR DRY DRAWING



The new Coulter & McKenzie ADJUSTABLE DRAW-CAST DIE BOX with true center-line pivotal action takes *all* the guesswork out of wire casting! You can *quickly* and *positively* establish the desired loop diameter and pitch of your wire with just 2 simple adjustments.

LOOK AT THESE ADVANTAGES:

1. Positive Adjustable Control of cast and pitch.
2. Completely eliminates or greatly reduces skilled use of casting rolls.
3. Positive locking of controls and die insures uniform constant cast, coil after coil.
4. Graduated indication permits keeping records for quality control and duplication when changing sizes or analysis.
5. Easy to install on most types of wire drawing equipment.

MODEL NO.	MAX. DIE SIZE CASING O.D.	NET WEIGHT	DIMENSIONS			
			A	B	C	D
1	1"	8 lbs.	2⅝"	4"	6"	4½"
2	1½"	14 lbs.	2⅞"	4½"	6½"	5"
3	2"	125 lbs.	5"	8"	9¾"	14"

Model No. 3 (Illustrated) may be arranged for direct water cooling of die casing.

U.S. and foreign patents applied for.

Barron & Crowther Ltd., Eastleigh, Hants, England. European Draw-Pak Licensee.

35 UNION AVENUE

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SINCE 1843 BRIDGEPORT 7 CONNECTICUT U. S. A.

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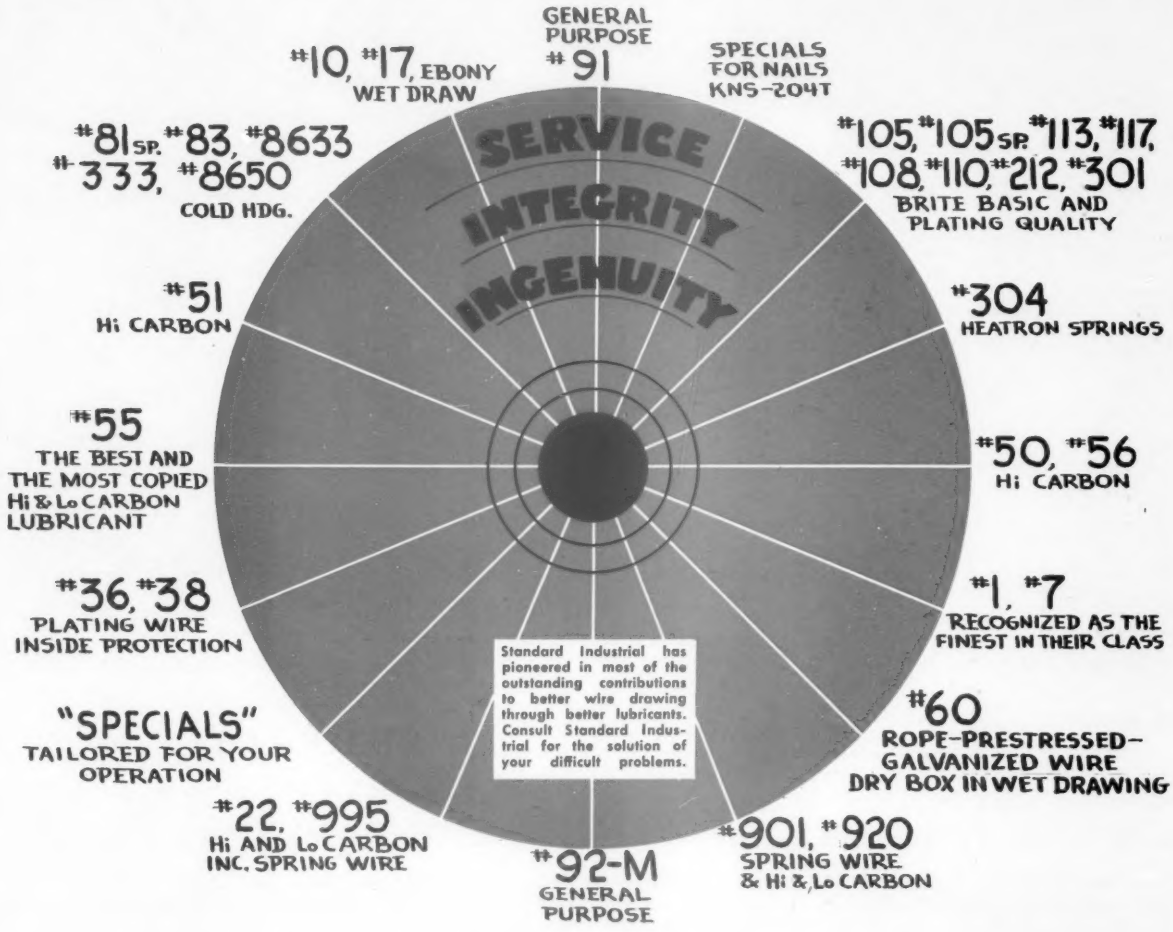
TO "KEEP YOUR SHOW ON THE ROAD" Use

"America's Finest Wire Draw"

We of Standard have concentrated our efforts, since our inception, toward the development of lubricants to solve your drawing problems!


GENERAL PURPOSE #91
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SPECIALS FOR NAILS KNS-204T
#81 SP. #83, #8633 #333, #8650 COLD HDG.
#105, #105 SP. #113, #117, #108, #110, #212, #301 BRITE BASIC AND PLATING QUALITY
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INGENUITY
#51 Hi CARBON
#304 HEATRON SPRINGS
#55 THE BEST AND THE MOST COPIED Hi & Lo CARBON LUBRICANT
#50, #56 Hi CARBON
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Standard Industrial has pioneered in most of the outstanding contributions to better wire drawing through better lubricants. Consult Standard Industrial for the solution of your difficult problems.
"SPECIALS" TAILORED FOR YOUR OPERATION
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#901, #920 SPRING WIRE & Hi & Lo CARBON

These are our Prime Business, Not a sideline.

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COMPOUNDS CO., INC.

FRANKFORT, ILLINOIS

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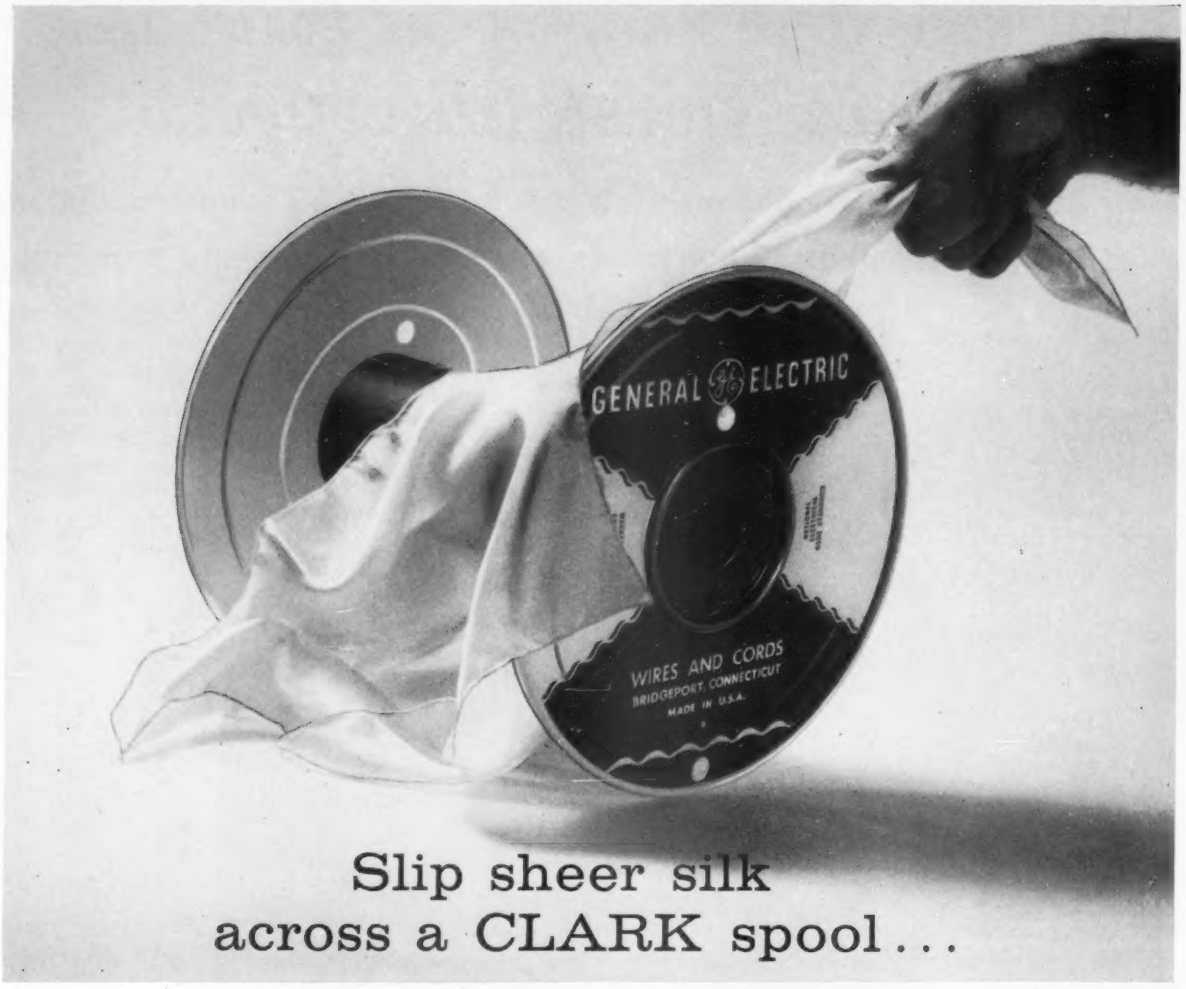

Slip sheer silk across a CLARK spool . . .

no snagging burrs, safe for hands and wire

Smooth, rounded edges of Clark wire spools eliminate any possibility of injury to hands or your product. Safety is one of the *many plus features* you get from J. L. Clark's superior spool technology.

Clark reinforces the strength of steel with locked-seam construction and a continuous bond between barrel and head which totally prevents independent turning of end, cap or center.

Select from a wide range of standard end diameters—or let Clark solve your special problem for any type of insulated or fine wire spool.

Your established design can be faithfully reproduced—or we will create a new one for you.

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Aren't these reasons why you should check on Clark's wholly integrated spool service? For complete details, ask for our booklet, "Spools for Insulated Wire." *J. L. Clark Manufacturing Co., Rockford, Illinois; Liberty Division Plant and Sales, Lancaster, Pa.; New York Sales Office, Chrysler Bldg., New York 17.*

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J. L. CLARK

Naugatuck PARACRIL OZO

The oil-resistant, ozone-resistant nitrile rubber

Now! lasting **COLORS** in rubber wire jackets

A development of Naugatuck research makes it possible to combine in a vulcanized rubber wire jacket all these properties:

- Excellent resistance to ozone and outdoor "weathering"
- Outstanding heat resistance
- High abrasion resistance
- Excellent oil, grease and chemical resistance
- Fast CV extrusion

...PLUS PERMANENT BRIGHT COLORS

In addition to the suggested uses, you will think of dozens of other applications where wire jacketing with all these properties can serve either an aesthetic or utilitarian purpose.

One of Naugatuck's technical representatives will be happy to discuss with any prospective user the formulation of the Paracril® Ozo compound which makes possible this combination of properties... not only in wire jacketing but also in shoe soles, hose jackets, weather stripping and other vulcanized rubber products.

Naugatuck Chemical

Division of United States Rubber Company 941P Elm Street Naugatuck, Connecticut

Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices • CANADA: Naugatuck Chemicals Division, Dominion Rubber Co., Ltd., Elmira, Ontario • CABLE: Rubexport, N.Y.

New "Pre-Extruder" Resistoneal*

Latest Advance in Automation for the Wire Industry

Syncro Introduces Equipment For Non-Stop Operation in Plastic Extruding Process

"Pre-extruder" RESISTONEAL*, Syncro Machine Company's most recent advance in automated wire handling processes, is the wire industry's answer for a continuous operation incorporating annealing and plastic extruding.

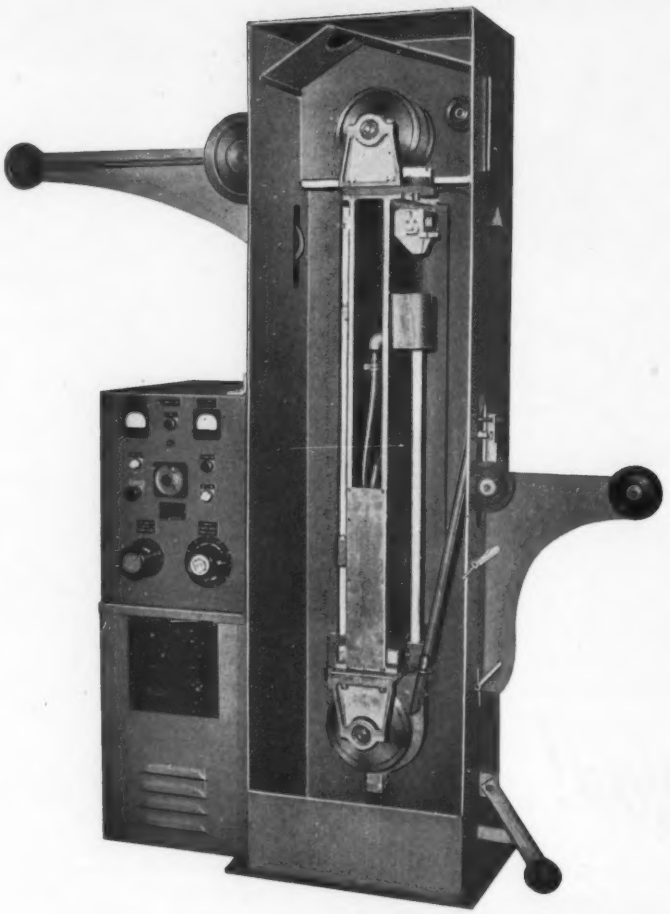
The new "Pre-extruder" anneals hard-drawn copper wire, cools it to a "below-oxidizing" temperature, and then reheats the wire before it enters the plastic extrusion process. At the present time these units are used extensively in the manufacture of plastic insulated telephone and communication wires.

A continuous supply of wire is accomplished by pre-welding operations on supply wire from spools or containers. This assures an uninterrupted flow of wire entering the annealing and extruding process.

Individual motors, drives, and associated controls are furnished as standard equipment with the "Pre-extruder" Annealer. All three elements are adaptable for interlocking with extruder drive arrangements.

The "Pre-extruder" Annealer incorporates the same basic features as the Syncro RESISTONEAL. The RESISTONEAL line has gained world-wide acceptance in annealing copper wire continuously in conjunction with wire drawing equipment.

* Trade Mark, Applied For



A detailed description and specification sheet on the "Pre-extruder" RESISTONEAL is now available. Direct your request to Syncro Machine Company, Dept. C, 611 Sayre Ave., Perth Amboy, New Jersey.

SYNCRO MACHINE COMPANY
Perth Amboy, New Jersey, U.S.A.
affiliated company: WINGET SYNCRO Ltd. Rochester Kent, England

SYNCRO®
Better Machinery for the Wire Industry

WIRE DRAWING MACHINES • DIE STRINGERS • CONTINUOUS ELECTRIC ANNEALERS • PAYOFFS • CAPSTANS • WIRE INSULATORS • HEAVY DUTY TAKEUPS • TAPERS • SPECIAL MACHINERY

WIRE AND WIRE PRODUCTS*

Reg. U. S. Pat. Off.

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 33 September, 1958 No. 9

Designated as Official Publication By The Wire Association

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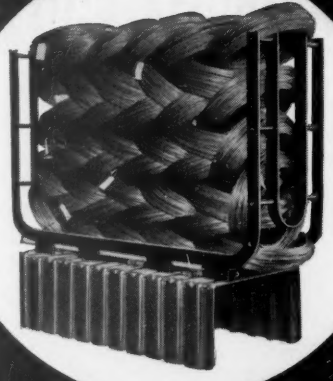
REPUBLIC
Stack 'N Store
UNITS



- Speed Wire Handling
- Save Floor Space
- Reduce Costs

Plagued by the problem of how to put existing wire-storage space to better use? Republic Stack 'N Store Units free valuable floor space for more productive purposes, and provide better inventory control.

Coiled wire is stacked in neat tiers in specially designed "U" shaped superstructure. Fully loaded superstructure is moved quickly and easily by crane to production areas. Or it may be placed on a skid and moved by lift truck to a storage area for future use.

Stack 'N Store Units may be the answer to reduced costs and improved wire handling in your plant. Why not talk it over with a Republic Engineer? There's no obligation. Just mail the coupon.

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BERGER DIVISION
DEPT. C-4091-A
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☐ Send more information on Stack 'N Store Units.
☐ Have an engineer call.

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Company_____

Address_____

City_____ Zone____ State_____

AMERICAN AND CANADIAN WIREMEN PREFER MICRO-WELD BUTT WELDERS

BECAUSE . . .

They mean dependable equipment. They are built to meet specific welding requirements, and are adaptable either in the mill or laboratory.

Their ease of operation is appreciated both by the operators and management.

Perfect alignment of wire ends is assured on MICRO-WELD Butt Welders.

These are just a few of the users of the Model E-1-S MICRO-WELD Butt Welders in North America —

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British Ropes Canadian Factory, Ltd., Vancouver, B.C.
Canada Wire & Cable Co., Leaside, Ont.
Donald Wire Rope Co., Hamilton, Ont.
B. Greening Wire Co., Hamilton, Ont.
Hamilton Wire Products Ltd., Hamilton, Ont.
National-Standard Co., Guelph, Ont.
Northern Electric Co. Ltd., Lachine, Que.
Steel Co. of Canada, Hamilton, Ont.
Wrights' Canadian Ropes, Ltd., Vancouver

U.S.A.

Columbia-Geneva Steel Co., Pittsburg, Calif.
Colorado Fuel & Iron Corp., Pueblo, Colo.
K. H. Davis Wire & Cable Corp., Los Angeles, Calif.
E. H. Edwards Co., San Francisco, Calif.
Pacific Wire Rope Co., Los Angeles, Calif.
Acme Steel & Wire Co., Chicago, Ill.
American Steel & Wire, New Haven, Conn.
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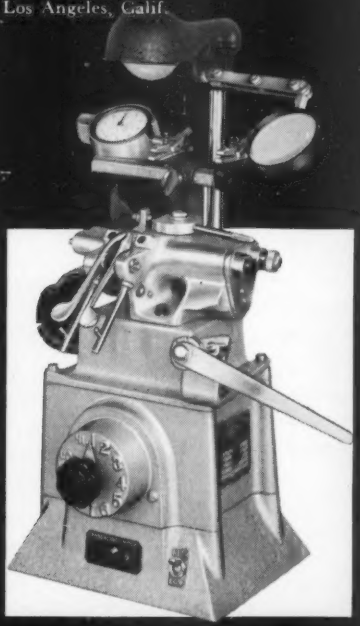

MODEL E-1-S MICRO-WELD BUTT WELDER. SUITABLE FOR BENCH MOUNTING

MICROMETER PRECISION — MICRO-WELD ®

MODEL E-1-S MICRO-WELD BUTT WELDER. MOUNTED ON 4-WHEEL TRUCK

Capacity .010" to .062" diameter high and low carbon steel wire, and alloy wire (thermocouple).

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MICRO PRODUCTS CO.

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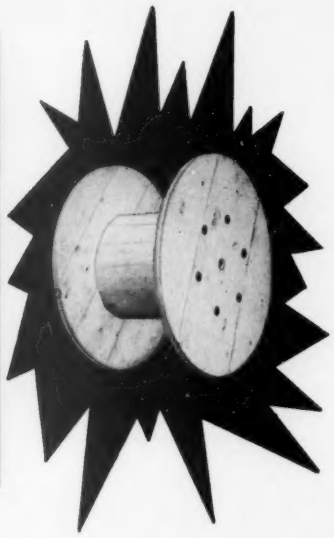
TELEPHONE STate 2-7468

YES

NON-RETURNABLE

WOOD REELS IN ALL SIZES FOR ALL TYPES OF ELECTRIC WIRE AND CABLE . . . . . .



YOU SAVE WITH NON-RETURNABLES

- Reduced Reel Investment
- Less Storage Space
- Lower Freight Costs
- No Repair Costs
- No Return Freight Charges
- No Bookkeeping
- No Deposits Needed
- No More Headaches!!

HIGH SPEED
SHIPPING SERVICE IN OUR OWN TRUCKS

within a radius of 200 miles from the plant. Fast freight will bring you Bridge reels within a few days east of the Mississippi.

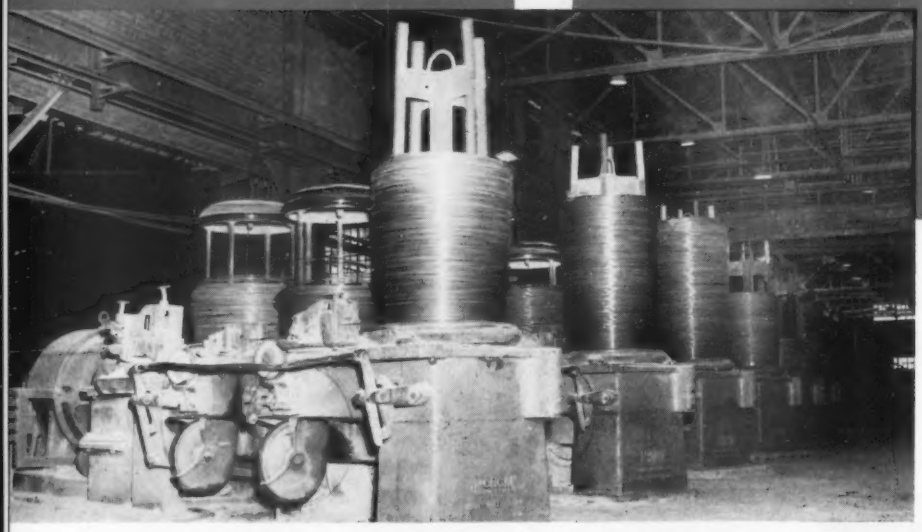
NON-RETURNABLE REELS GIVE YOU A DEFINITE PACKAGING COST

"REEL GOOD . . .

Let us quote on your reel needs. Send us your specifications. Better yet, visit our plant and see how and why Bridge reels are made so well at so low a cost.

WOOD REELS"

4 POINTS OF S



1 **PRODUCTIVITY**
Morgan machines provide trouble-free high speed production of heavyweight bundles.

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WIRE MACHINES

MORGAN CONSTRUCTION CO.
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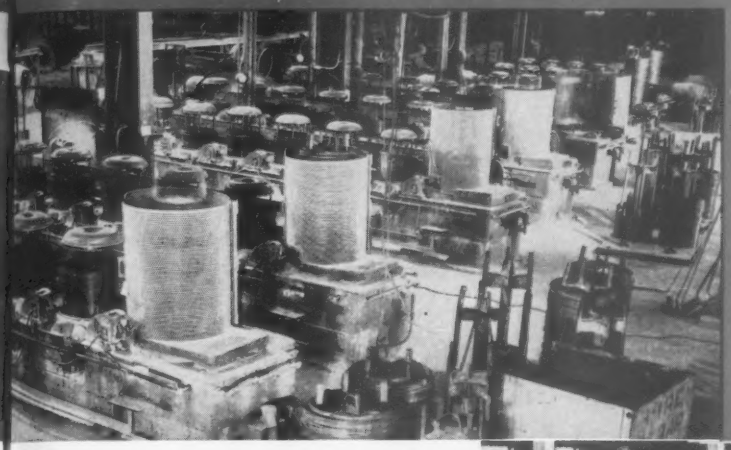
F SUPERIORITY . . .

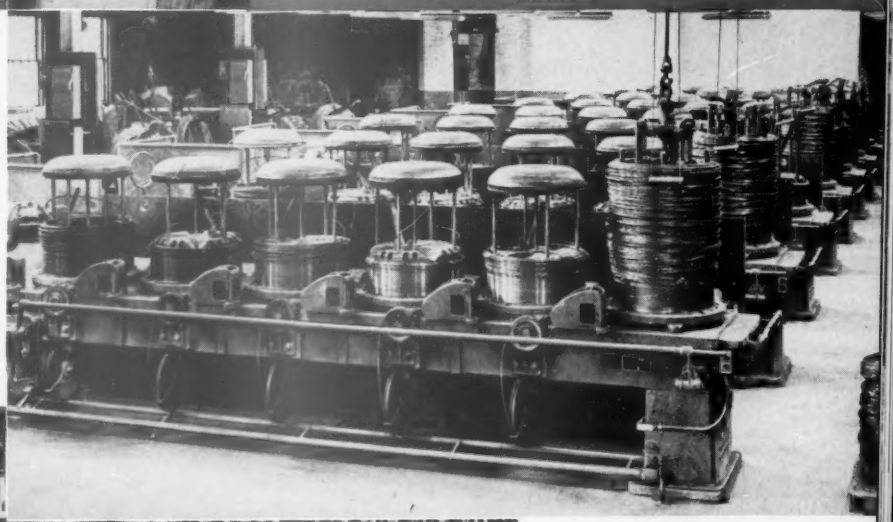


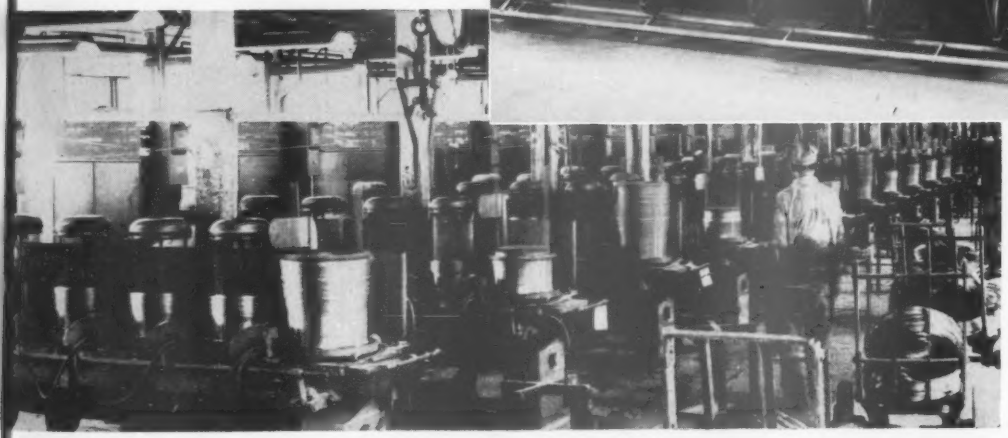
2

QUALITY OF PRODUCT
Air-cooled nonslip storage principal provides fast drawing—while meeting exacting physical specifications.

3

COMPACTNESS
High production per unit of floor space is obtained due to machine compactness.





4

ECONOMY
One of the Morgan machines' outstanding features is low power and low die cost per ton of wire drawn.

WM 1

U.S.I.

Vol. II, No. 6

POLYETHYLENE PROCESSING TIPS

RESIN PROPERTIES THAT AFFECT STRESS-CRACK RESISTANCE OF POLYETHYLENE

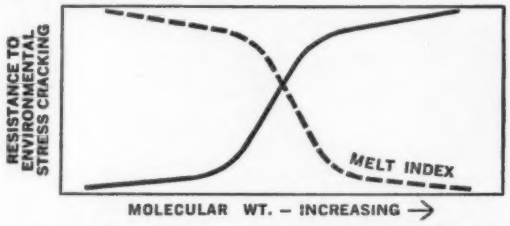
Environmental stress cracking is the term used to describe a certain type of material failure. With polyethylene this failure occurs when the plastic is under high local stress (either external or internal) and in contact with materials such as a soap, detergent, or solvent, which affects the polymer.

Resistance to stress cracking is especially important for applications such as electrical insulation, polyethylene pipe, housewares, and certain types of packages.

Two factors influence the resistance of a polyethylene part to environmental stress cracking: the resin used and the conditions used in fabricating the part.

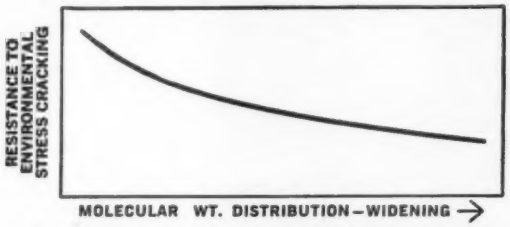
Which resin to use:

Stress crack resistance is greater with a resin of ***higher molecular weight*** – that is, lower melt index.



Then why not use low melt index resins? Because production rates are lower. The processor must make a compromise between peak production rate and top stress-crack resistance and use a resin that will be satisfactory, if not ideal, in both respects.

Molecular weight distribution of the polyethylene



resin is important too. Resins with a narrow molecular weight distribution (with fewer molecules much higher or lower than the average) have better stress crack resistance than those with wide molecular weight distribution (more of the larger and smaller molecules but the same average). The low molecular weight fraction is more susceptible to attack by environmental materials.

However, the flow properties of a polyethylene resin having a narrow molecular weight distribution and a given melt index are not as good as those of a polyethylene resin having a wide molecular weight distribution and the same melt index. Here again the processor must make a compromise between production rate and the properties he requires in the end product.

Density of the resin will also have an effect on the resistance of that polyethylene resin to environmental stress cracking. The higher the density, the poorer resistance to environmental stress cracking. On the other hand, the more linear or more dense polyethylenes have enhanced flow properties and higher stiffness and tensile strength.

There is no single answer to all problems

It is obvious from the preceding discussion that there is no simple solution to the selection of a resin for a particular end use. The resin must be carefully selected while giving proper consideration to the important end properties required in the fabricated article.

An answer to your particular problem can be found by obtaining a polyethylene resin from a manufacturer who can give you the balance of properties required – high or low melt index, narrow or wide molecular weight distribution, a range of densities. U.S.I. is one such supplier and their Technical Service Representatives stand ready to assist you in the selection of the proper Petrothene resin.

Processing conditions affect stress crack resistance

Processing temperatures, cooling rates, and other processing conditions can have a marked effect on stress crack resistance, because of residual strains left in the fabricated article.

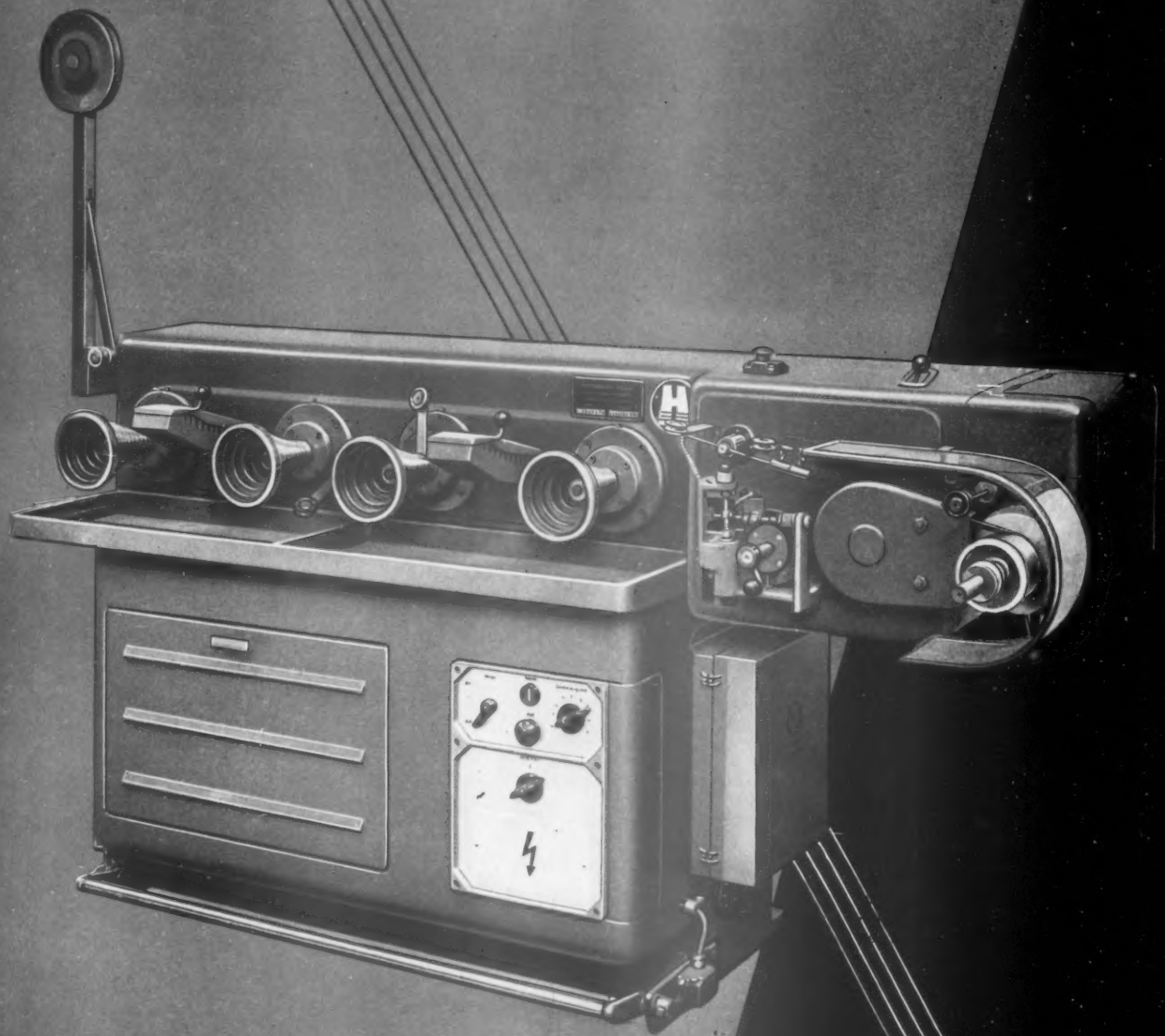
There isn't room to go into these in detail here but the next issue of "Tips" will discuss them more fully.

Meanwhile if you have a specific problem, call on U.S.I.'s Technical Service Engineers. They will be glad to work with you toward finding a solution.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corporation
99 Park Avenue, New York 16, N. Y.
Branches in principal cities

HERBORN

Drawing Machines for ultra fin



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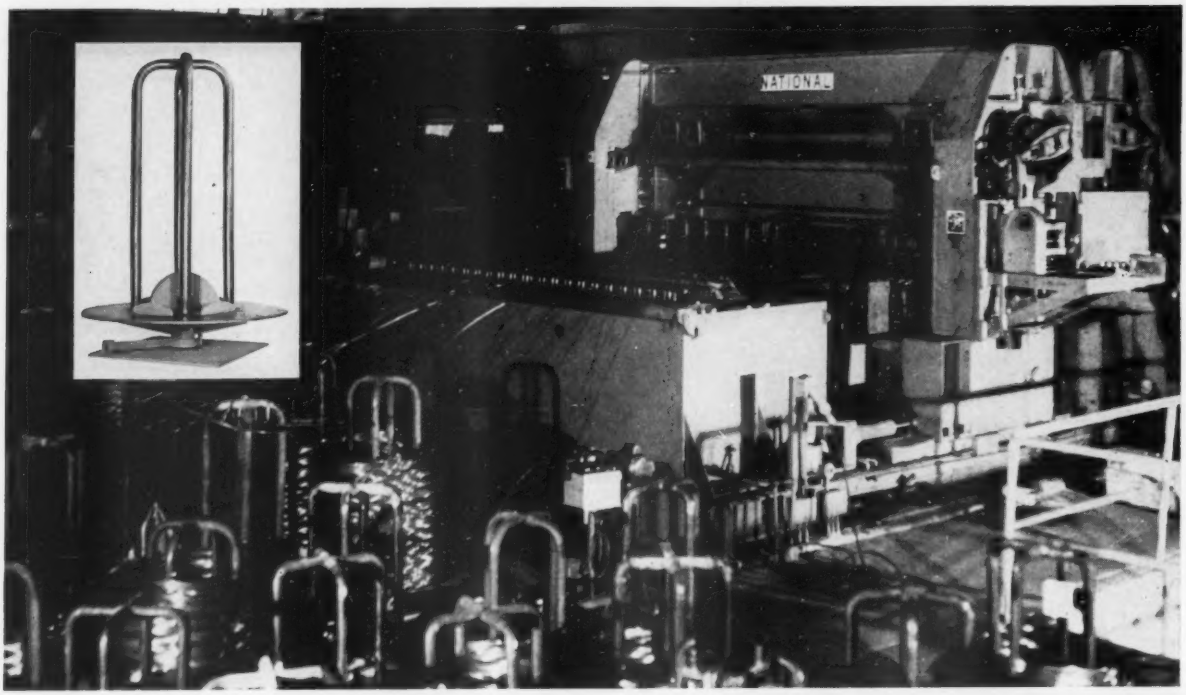
Sole Representative in Canada: PAUL REICHER, P. O.

WORKING WONDERS WITH WIRE: down goes down-time at Continental Steel Corporation's Kokomo, Indiana Plant

...as in go **Northern Indiana Steel's high-capacity, heavy-duty**

WIRE CARRIERS and PAY-OFF REELS



THIS is the way Continental Steel Corp., Kokomo, Indiana, handles wire easily and economically. This is the way Continental and other major wire and wire fabric producers feed their giant machines with minimum interruption. These rugged, operation-proved wire carriers and reels by Northern Indiana carry up to 4,000 lbs. Stack easily, too, for space-saving storage.

WE BUILD THEM THE WAY YOU WANT THEM

In addition to the standard model shown here, we can produce units to any standard size and specification you may require. If you have a special operating problem, send us a drawing showing dimensions and other variations needed. We will quote you in the quantities specified.

NORTHERN INDIANA STEEL SUPPLY CO., INC.

Fabricating Division, Michigan City, Indiana

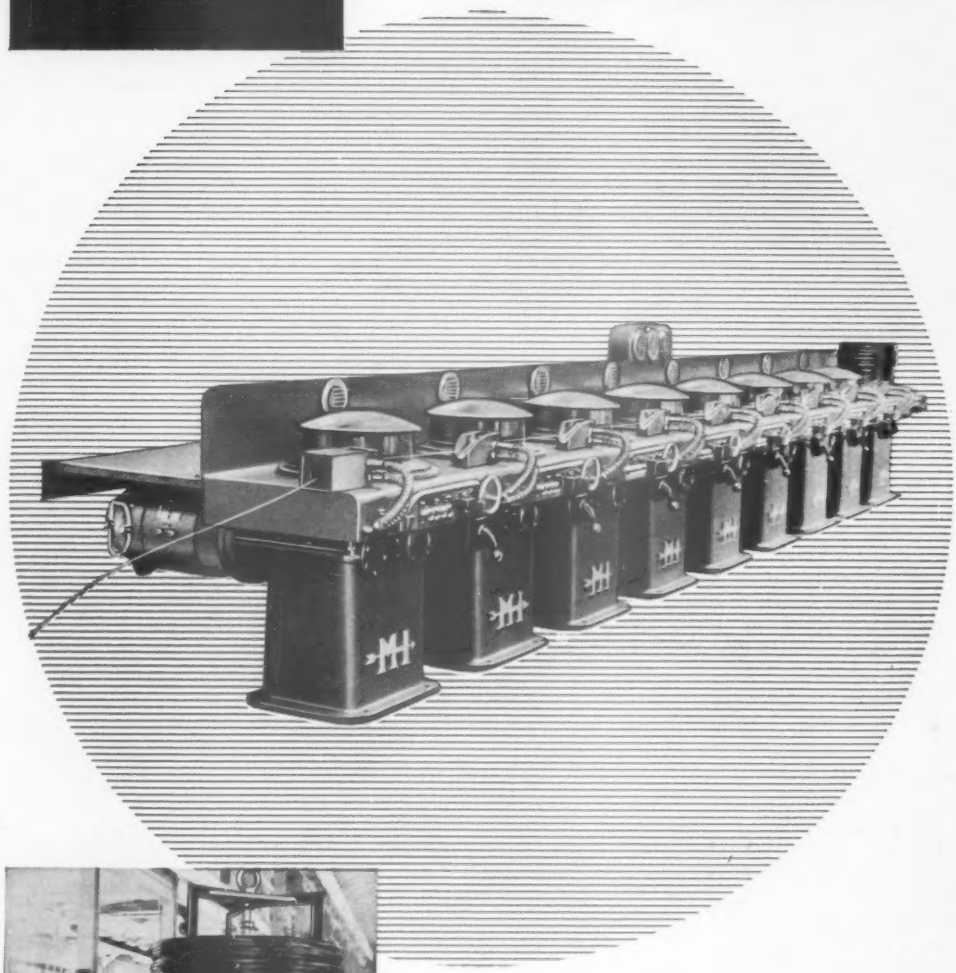
TELEPHONE TRiangle 4-3241

Three sizes for all types
of material
Optional number of blocks

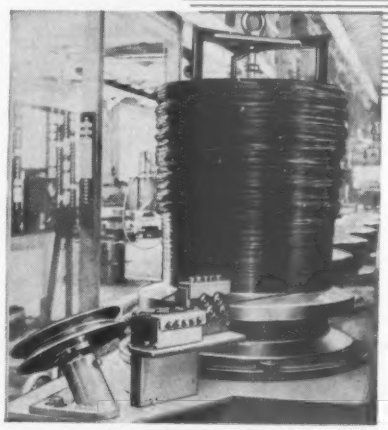
Our experience in building
wire drawing equipments
during 60 years
is your guarantee

THE BEELINE

**Designed and built to meet
today's requirements for trouble-free
high production wire drawing**



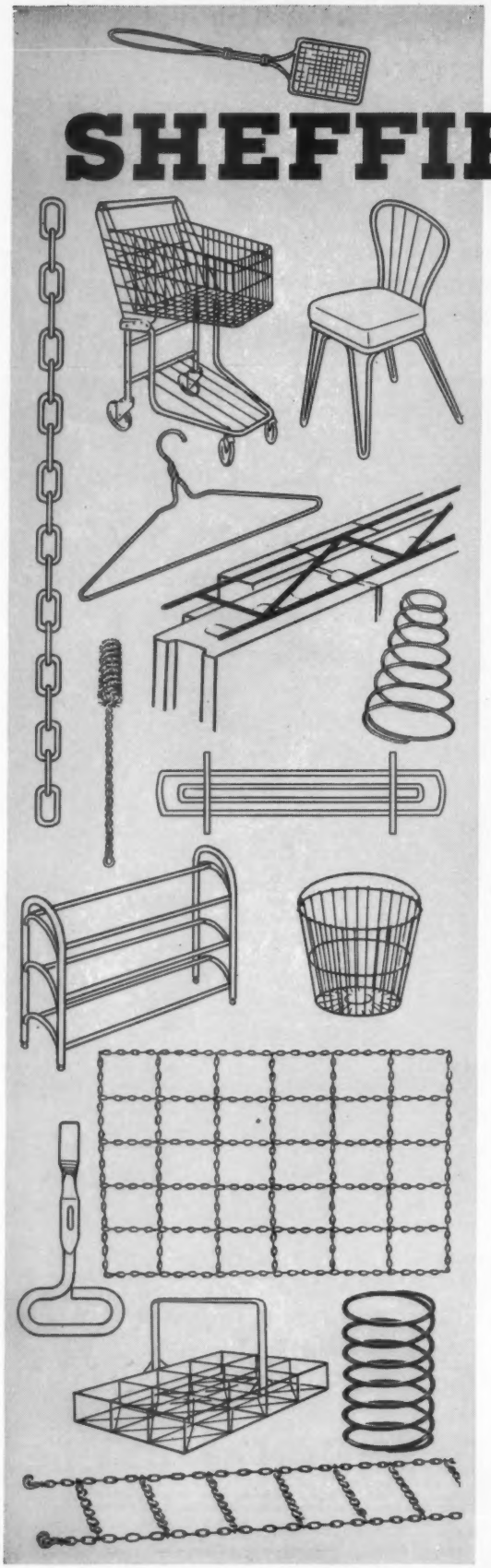
*The smallest size:
BEELINE DM 3 with
nine 16" blocks*



*Double decked finishing block
with straighening device*

MORGÅRDSHAMMAR
MORGÅRDSHAMMARS MEK. VERKSTADS AB • MORGÅRDSHAMMAR • SWEDEN

Cable: Morgårdshammar, Ludvika. Telephone 0240-71100.
U S office: 19002 Lomond Boulevard Cleveland 22, Ohio.



Why manufacturers use

SHEFFIELD WIRE

in more than 2,000 quality products

Manufacturers and fabricators depend on Sheffield Wire for unvarying quality and accuracy in meeting their wire specifications. They are sure of getting the RIGHT wire—and getting it fast—because of Sheffield's advanced quality controls and strategic plant locations.

We're old hands at helping customers solve wire problems—with results that speed production, cut costs and improve products.

Let our metallurgists and wire specialists analyze your wire uses. We'll not only come up with the right wire for you, but also may be able to recommend more economical ordering units. This service is yours for the asking. Just call your nearest Sheffield office.

SHEFFIELD KONE PAK*

gives you in one continuous spool the equivalent of 2 to 40 ordinary coils of wire. It gives longer continuous runs, less down time, and can cut scrap losses as much as 90%. The Kone Pak is mounted on a disposable wooden pallet, and can be packed in streamlined cardboard container if desired.

SHEFFIELD ARMCO® WIRE PRODUCTS

Coiled Wire

Annealed—#20 (.035" ga.) through 1"

Galvanized—#20 (.035" ga.) through #4 (.225" ga.)

Bright—#20 (.035" ga.) through 1"

Straightened and Cut Wire

Annealed—#20 (.035" ga.) through ¾"

Galvanized—#20 (.035" ga.) through #4 (.225" ga.)

Bright—#16 (.0625" ga.) through ¾"

* Patent Pending

New ALUMINIZED WIRE
16 ga. (.0625") through 6 ga. (.192")
WRITE FOR FREE SAMPLE

SHEFFIELD DIVISION
ARMCO STEEL CORPORATION
SHEFFIELD PLANTS: HOUSTON • KANSAS CITY • TULSA

these thermatic Series* extruder

features mean higher production on every job!

Simplified one piece cylinder with integrally cast-in Xalloy liner.

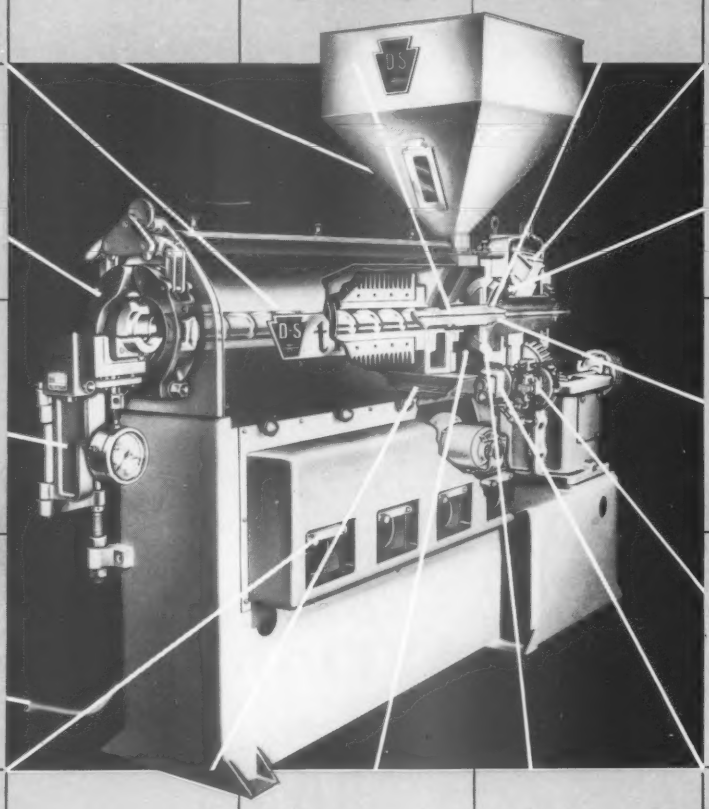
Extra large capacity stainless steel hoppers.

Screw flight extends back beyond the feed throat opening for improved powder and granule feeding.

Four-spline screw drive eliminates the eccentric screw rotation of a single key drive.

Helical gearing — smooth, efficient, free-running. Greatly increased horse-power capacity.

New stronger head clamp. Simplified opening and closing of head with positive safety shear pin arrangement.



Higher thrust bearing capacity. Extra-heavy separate thrust and radial bearings handle their respective loads individually to meet constantly increasing production requirements.

Improved hinged head support swings completely clear of the front of the extruder.

Tapered drive end of stock screw positively centers screw and simplifies removal.

Heaters and controllers completely wired for fast inexpensive installation.

Gear type oil pump, positively driven from input shaft, lubricates all bearings and gears regardless of speed.

Damper arrangement provides several gradients of natural draft cooling. Blowers provide high circulation for stubborn cooling jobs.

Air-tight oven effect adjustment by new second set of dampers for high temperature extrusion.

Access opening allows easy replacement of bronze feed throat bushing.

Labyrinth oil seals — simple non-wearing design. No oil seals or rings to replace.

Built-in direct drive stock screw electric tachometer.

Greater cylinder lengths standard on all extruder sizes with optional L/D ratios available. **2½", 3½", 4½", 6" and 8" models available.** The New D-S thermatic Series Extruders will outproduce — size for size — any other extruder on the market today. For complete specifications and details write to:

DAVIS-STANDARD
Division of FRANKLIN RESEARCH CORPORATION
16 WATER STREET, MYSTIC, CONNECTICUT

*Patented

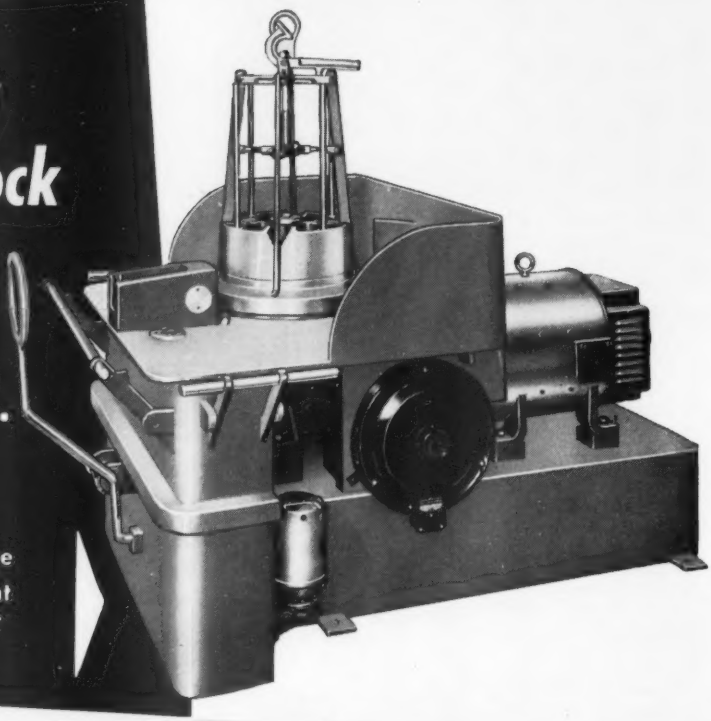
IN CANADA CONTACT E. V. LARSON CO. LTD., 572 QUEEN STREET EAST, TORONTO 2, ONTARIO
IN EUROPE AND THE STERLING AREA CONTACT FAWCETT, PRESTON & CO. LTD., BROMBOROUGH, ENGLAND

wire ENGINEERED

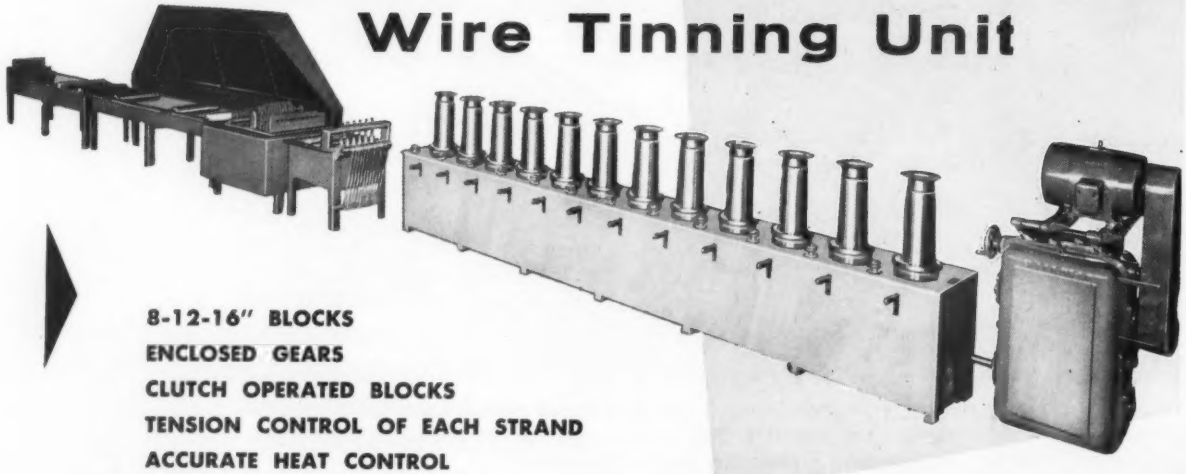
Wet or Dry Motorized Block

Self contained Lubricant Tank and Pump . . . . .

Variable Speed
Wet Drawn Finish from Dry Coated Wire
Accurate Die Adjustment for Perfect Lay and Cast



Wire Tinning Unit



8-12-16" BLOCKS
ENCLOSED GEARS
CLUTCH OPERATED BLOCKS
TENSION CONTROL OF EACH STRAND
ACCURATE HEAT CONTROL

wire ENGINEERING ASSOCIATES, INC.

16130 VAN DRUNEN ROAD • SOUTH HOLLAND, ILLINOIS

Midwest Representative: Bronson & Bratton Inc., Chicago 32, Illinois

... Results of a Superior Beginning

The countless parts and products made from Roebling high-carbon steel spring wire and flat spring steel have one thing in common . . . their superior quality. This, of course, is related to the inherent fineness of the materials.

The variety in which Roebling offers these spring materials is equally impressive. They are available in hard drawn, hard rolled, annealed or soft, tempered or untempered. Types include zigzag and no-sag wires; upholstery and mechanical spring wires; valve spring wire; clock- and motor-type spring steels and flat spring steels of all types and description.

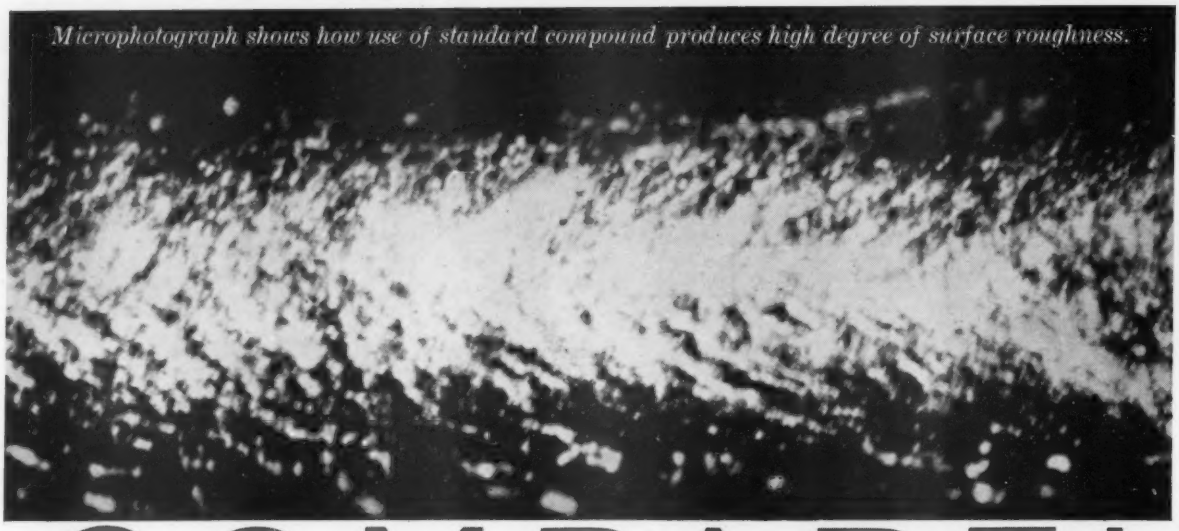
Whatever the type, size or characteristics you require—Roebling can fit your needs exactly. You'll find that Roebling quality means maximum production from your machines and consistent uniformity in your product.

For spring wire and flat spring steel information, contact Wire and Cold Rolled Steel Products Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

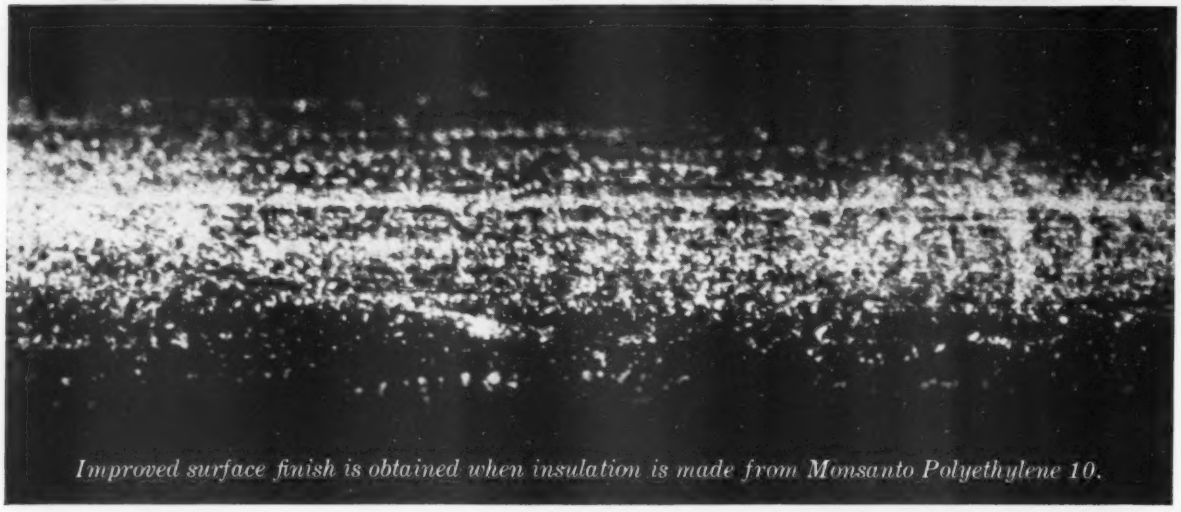
Branch Offices in Principal Cities—Subsidiary of The Colorado Fuel and Iron Corporation

Roebling... Your Product is Better for it



Microphotograph shows how use of standard compound produces high degree of surface roughness.

COMPARE!



Improved surface finish is obtained when insulation is made from Monsanto Polyethylene 10.

FOR SMOOTHNESS

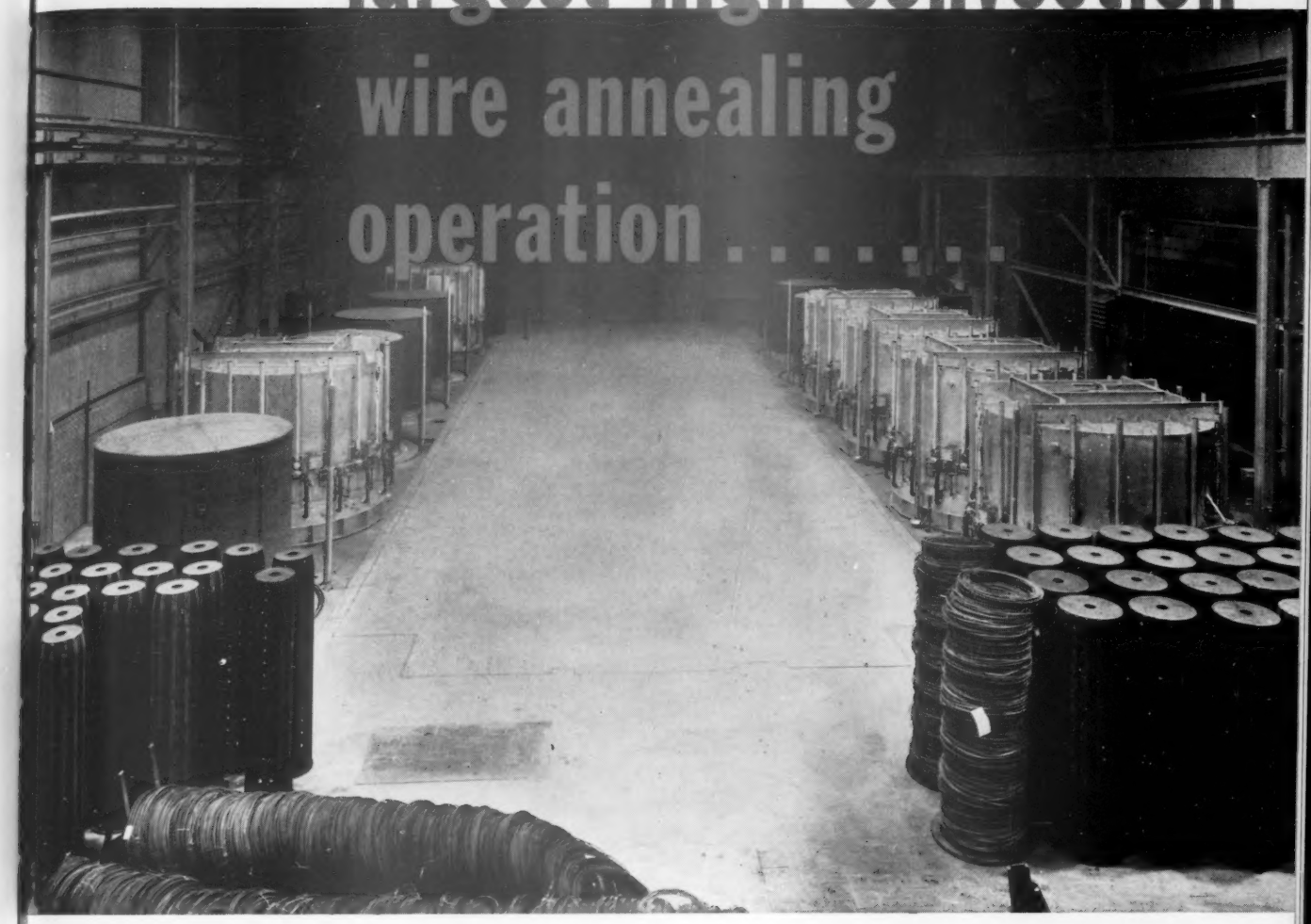
Monsanto's new natural polyethylene insulating compound, Monsanto Polyethylene 10*, promises improved surface finish in extruded primary insulation.

New Monsanto Polyethylene Insulating Compound (MPE 10) offers telephone cable manufacturers superior extrudability at high rates, along with the smooth surface finish that can reduce frequency of sparker failure during twisting and cabling operations. MPE 10—thoroughly tested in commercial applications—meets standard telephone cable requirements. Write for complete data to Monsanto Chemical Company, Plastics Division, Room 544, Springfield 2, Massachusetts.

Monsanto

**Improved Monsanto Polyethylene 122531*

Here is America's largest high convection wire annealing operation . . . . . .



it's the largest installation of the largest furnaces

For the first time it is possible to anneal four large spindles of rod in a single charge in the efficient bell type high convection furnace.

Lee Wilson engineers recently set into operation six of the largest bell type radiant tube high convection furnaces ever built. With a charge diameter of 114" and a piling height of 108", these rod and wire coil annealing furnaces have a heat input of 5,000,000 BTU per hour per furnace.

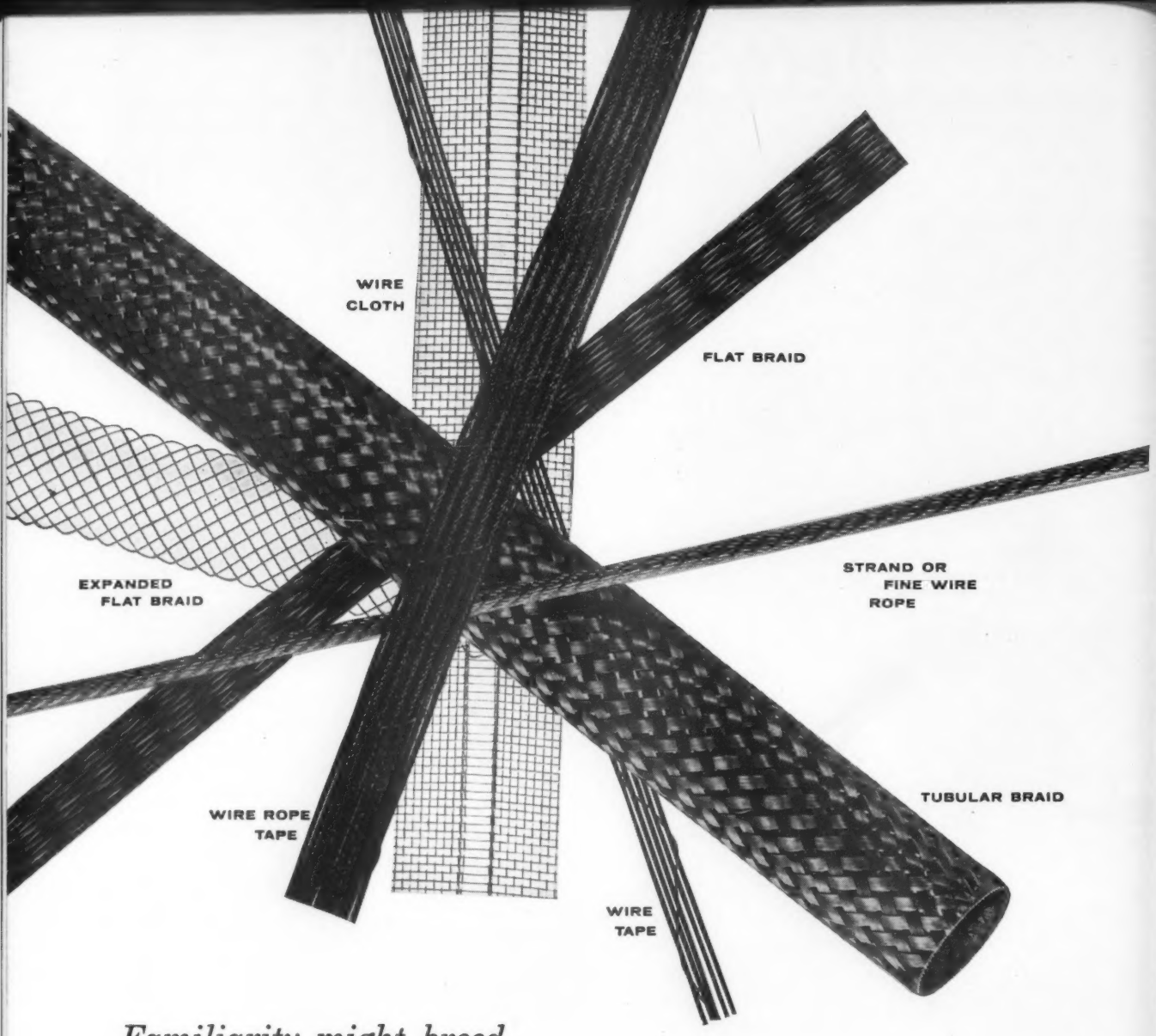
The installation, made in one of the nation's largest wire and rod plants, consists of 6 furnaces and 12 annealing bases with 25 HP fan drives. The newest type of spider and coil loading and stripping machine is used to load the coils on the bases.

If you're considering new annealing equipment, make certain you keep up with competition—get the facts on this new Lee Wilson furnace.

Lee Wilson* ENGINEERING COMPANY, INC.
20005 WEST LAKE ROAD • CLEVELAND 16, OHIO

HIGH CONVECTION ANNEALING FURNACES
MAKE THE BEST METALS BETTER

*ORIGINATORS AND LEADING PRODUCERS OF HIGH CONVECTION ANNEALING FURNACES



Familiarity might breed

NEW PRODUCT IDEAS!

The wire fabrications shown here, highly developed specialties of National-Standard, are available in many types and sizes. Each can be produced in any metal that can be drawn into wire.

These materials are used in numerous products today for many different reasons . . . for strengthening, stiffening, protection, safety, decoration, filtering, screening, heat or electrical conductivity, grounding, etc., etc.

Can one of these materials meet a present or new product requirement of yours? You'll never find an organization more cooperative or better qualified to help you fully explore any such ideas. Just get in touch with National-Standard, Niles, Michigan.

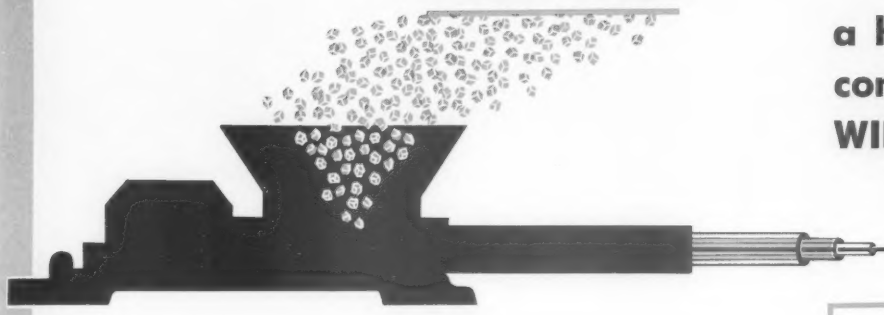
NATIONAL NS NATIONAL-STANDARD Company NILES, MICHIGAN **STANDARD**

DIVISIONS: NATIONAL-STANDARD, Niles, Mich.; *tire wire, stainless, music spring and plated wires, flat and tubular braid and wire cord*
WORCESTER WIRE WORKS, Worcester, Mass.; *music spring, stainless and plated wires, high and low carbon specialties* • **REYNOLDS WIRE, Dixon, Ill.;** *industrial wire cloth*
WAGNER LITHO MACHINERY, Secaucus, N. J.; *metal decorating equipment* • **ATHENIA STEEL, Clifton, N. J.;** *flat, high carbon spring steels*

Versatility!

APEX PVC COMPOUND No. 128

a high quality compound for WIRE and CABLE



HARDNESS, DURO "A" 88

SPECIFIC GRAVITY 1.37

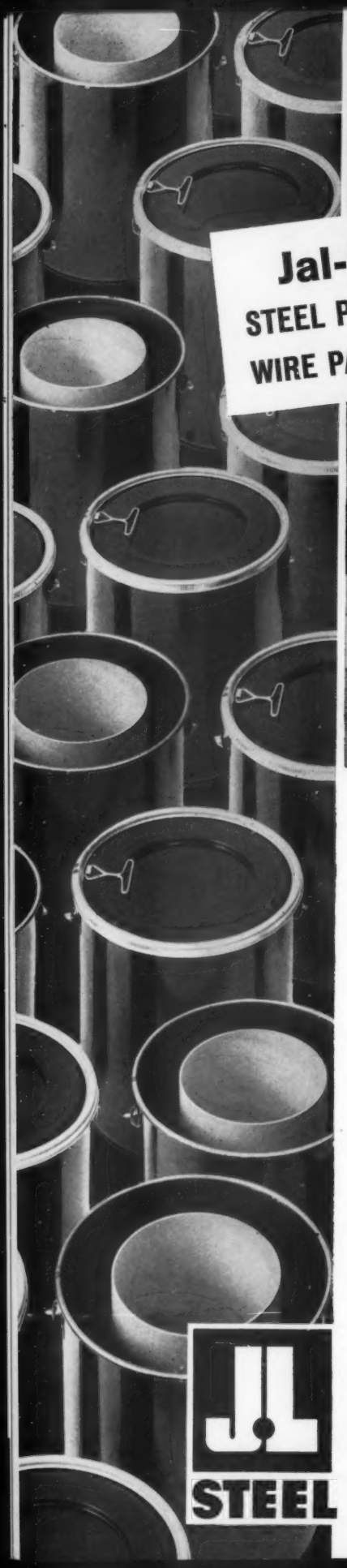
ECONOMICALLY PRICED

- U. L. Recog. T, TW oil 60°C
- U. L. Recog. 80°C appliance wire
- U. L. Recog. UF - NMC
- MIL-W-76A
- Primary Insulation and Jacket
- General Purpose - 40° to 80°C

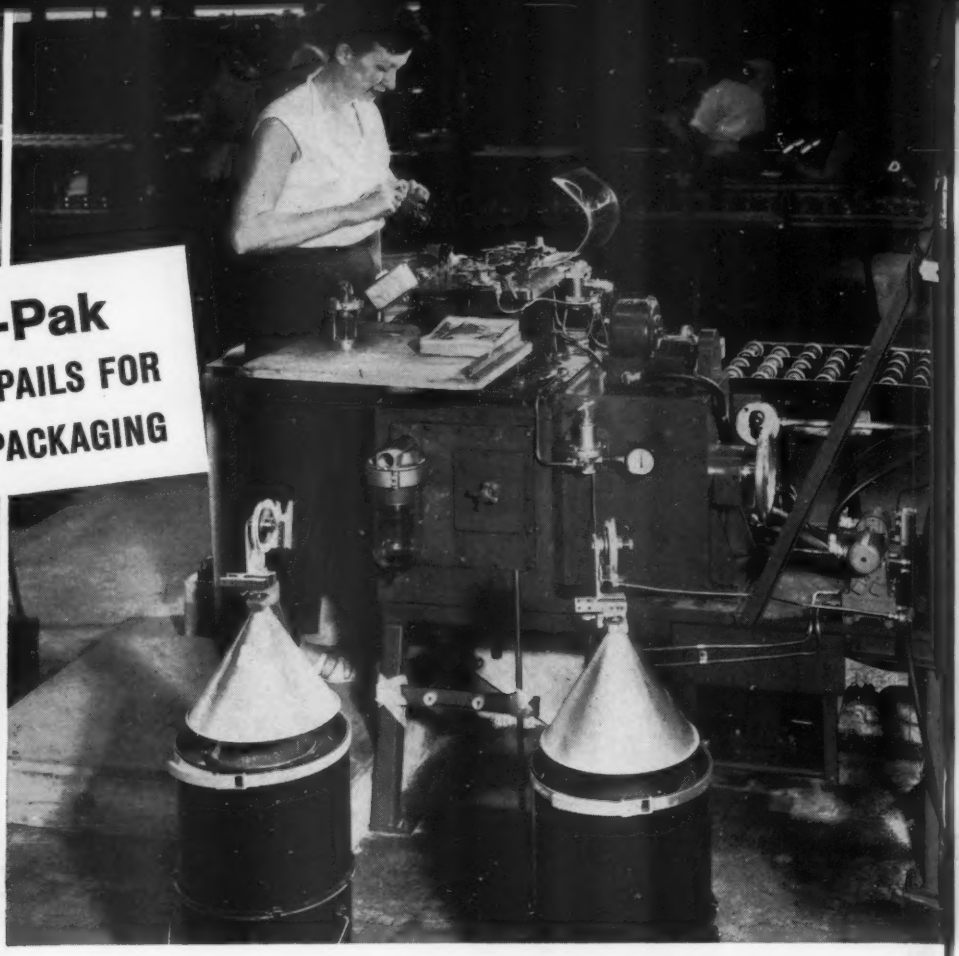
We produce the PVC compound for your requirements . . . or we will develop a compound especially for you.

Technical data supplied on request.

APEX TIRE & RUBBER CO. Plastics Division Pawtucket, R. I., U. S. A.



Jal-Pak
STEEL PAILS FOR WIRE PACKAGING



This operator is winding 27-gauge wire at 300 feet per minute from Jal-Pak pails supplied by Rea Magnet Wire Company, Inc. In other operations, Fasco has de-reeled wire as fast as 2700 feet per minute.

"We reduced labor costs $20,000 a year with Jal-Pak pails"

...reports FASCO INDUSTRIES, INC.

"We have saved up to $20,000 a year in labor costs alone by using these wire pails for handling copper magnet wire from 25 to 31 gauge," states Mr. Charles Weiland, director of purchases of Fasco Industries, Rochester, N.Y. "Other savings result in reduced scrap loss and the elimination of wire spools."

Jal-Pak steel wire pails prevent wire breakage, snarling and kinking of wire. Complete protection is assured by smooth side seams and inner surfaces. Rethreading and rejoining are materially reduced. No deposit or return are required.

Some companies have reduced downtime as much as 90% in packaging wire with Jal-Paks. The unique pails are now successfully used with brass, copper, steel, aluminum, stainless steel, alloys, welding and soldering wires.

For facts on how Jal-Paks can cut your costs, write direct to Jones & Laughlin, Container Division, 405 Lexington Avenue, New York 17, New York.

Jones & Laughlin Steel Corporation

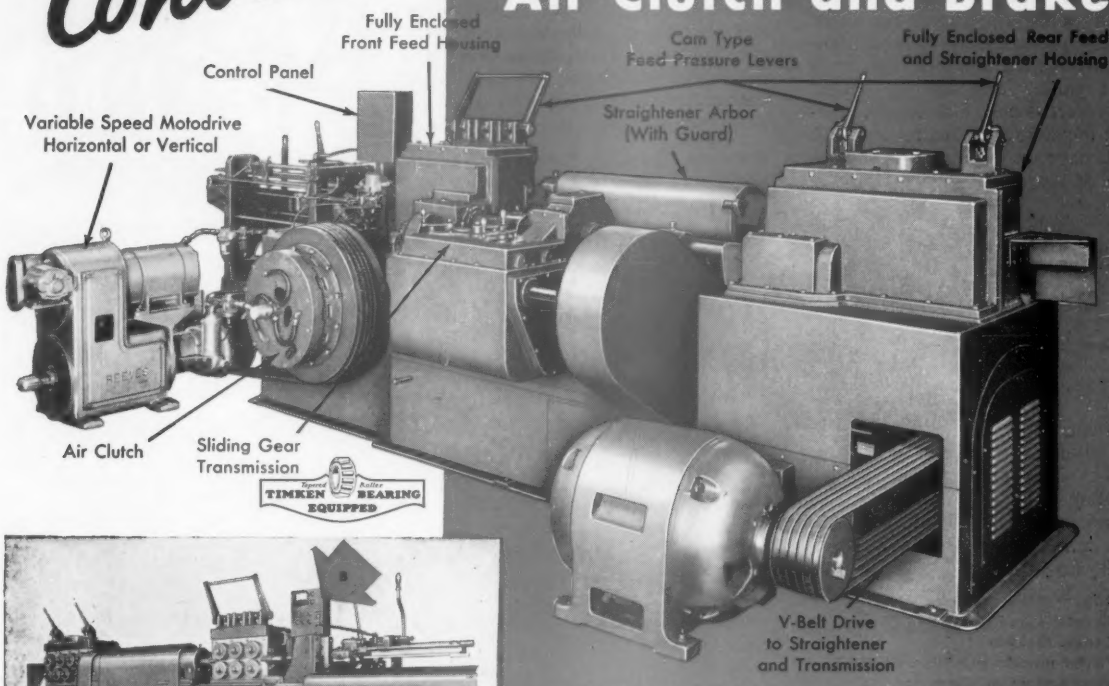
CONTAINER DIVISION
405 LEXINGTON AVENUE, NEW YORK 17, NEW YORK

J&L STEEL

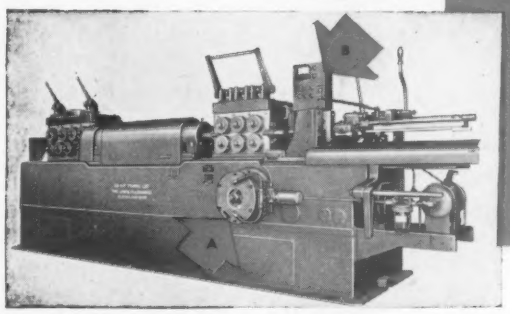
Better Quality Control ✳

LEWIS

Wire Straightening and Cutting Machines with Air Clutch and Brake


Fully Enclosed Front Feed Housing
Cam Type Feed Pressure Levers
Fully Enclosed Rear Feed and Straightener Housing
Control Panel
Straightener Arbor (With Guard)
Variable Speed Motodrive Horizontal or Vertical
Air Clutch
Sliding Gear Transmission
Tapered Roller TIMKEN BEARING EQUIPPED
V-Belt Drive to Straightener and Transmission

No. 11-F Travel-Cut with Flying-Shear Cut-off. Capacity ½" to ¾" diameter. 75-135 feet per minute. Rear view (above) with guards removed showing air clutch and drive.



Front view of No. 11-F Travel-Cut with Flying Shear Cut-off showing Air Brake "A" (with guard removed) and operating panel "B" with push-button controls for Air Clutch, Reeves Motodrive and flywheel speed Indicator Tachometer.

● Lewis engineers have added three important improvements to their famous Travel-Cut Machines for BETTER QUALITY CONTROL . . . These machines are already in service in America's leading steel and wire mills.

✳ Wichita Air Clutch permits higher cut-off speeds, eliminates shock of conventional clutch. No adjustment necessary . . . automatically compensates for wear.

✳ Wichita Air Brake eliminates conventional mechanical drag brake and is only engaged for a short portion of the cut-off cycle.

✳ Reeves Variable Speed Motodrive permits infinite adjustment of flywheel speed for perfect synchronization of the cut-off and wire feed speeds. This unique arrangement makes possible the cutting of rod WITHOUT SPOT SWELL . . . allows finer adjustment for cutting short lengths. Dial tachometer registers flywheel speed.

There are Standard Lewis Travel-Cut or Stationary-Cut Machines designed to straighten and cut all materials and shapes in wire or rod from .012" to ¾" at a wide range of feed speeds.

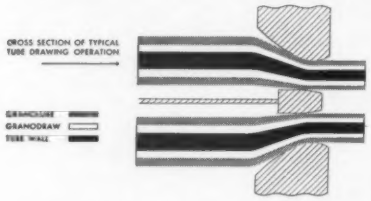
Air Clutch available on all Travel-Cut Models. Send for new brochure showing complete line of Lewis Wire Straightening and Cutting Machines.

LEWIS MACHINE COMPANY 3440 East 76th Street Cleveland 27, Ohio

CHEMICAL CONVERSION COATINGS and their functions in facilitating the cold mechanical deformation of metals

By ARTHUR DAHL, Product Development Dept., AMCHEM PRODUCTS, INC.

When used to facilitate the cold mechanical deformation of metals (in drawing, extrusion, stamping, cold heading, necking, and upsetting operations) chemical conversion coatings in conjunction with suitable lubricants perform three important functions. One, they prevent metal-to-metal contact between work and tool. Two, they prevent galling and seizing. Three, they protect stock indefinitely, permitting the storage of in-process work at any stage of production, without danger of corrosion damage.



Characteristic of the tightly bound, highly absorptive, crystalline coating formed by the processes is the ability of the coating to retain lubricity throughout forming operations when treated with a suitable lubricant. This offers the following production advantages:

- Higher degree of reduction
- Greater speed of draw
- Longer tool life
- Fewer process anneals and pickling
- Finer surface finish
- Cleaner mills
- Easier inspection of finished product

Also of interest to production men is the exact duplication of coatings from batch to batch. And the processes are much simpler than other methods of coating metals—baths can be set up and running in less time than it takes to determine suitable coatings by other methods.

TYPES OF COATINGS AND THE METALS FOR WHICH THEY ARE DESIGNED

Zinc phosphate coatings for carbon steel. These coatings can be applied by either dip or spray systems.

Dip. ACP Granodraw No. 1 is typical of the dip process. The sequence includes precleaning, water rinse, pickling, water rinse, water rinse, Granodraw No. 1 solution, water rinse, and a hot neutralizing rinse. Surfaces to be treated must be free of oil, grease, rust and scale. The above sequence insures that they will be. And when metal is free of rust and scale, the pickling bath and two succeeding water rinses can be omitted. In either case, a lubricant like ACP Granolube or conventional lubricant must be applied prior to working the metal.

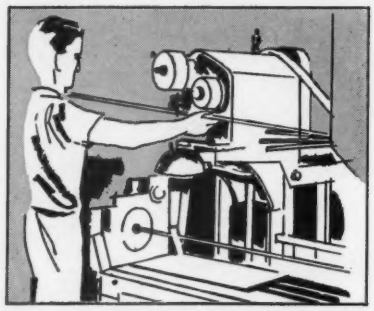
Spray. ACP Granodraw No. 4 is an example of the spray process. It usually requires 5-stage equipment and includes the following steps: precleaning, water rinse, Granodraw No. 4 solution, water rinse, lubricant. After chemical treatment, the work must be dried before forming.

Oxalate Coatings for the stainless steels and many of the high nickel alloys. These coatings are applied only by immersion process, and usually in a 5-stage system which includes an acid pickling or depassivating bath, a water rinse, the ACP Granodraw SS coating bath, a hot borax neutralizing rinse for wire stock, or a lubricating bath for tube stock. Since thorough activation of the metal surface is necessary to promote an adherent coating, the pickling and activating bath is an important stage in processing.

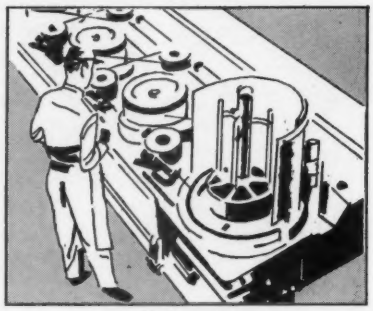
Fluoride-type coatings for zirconium and its alloys. Granodraw ZR is such a coating. It is applied in an immersion process which includes precleaning, water rinse, pickling, water rinse, Granodraw ZR solution, water rinse, drying or lubricating. It has been used primarily in the treatment of stock prior to wire drawing and tube drawing. Surfaces are cleaned of oil and grease by solvent degreasing or alkali cleaning. Pickling is required to provide a surface that is chemically and metallurgically receptive to the coating.

Strong alkali coatings for tantalum and amorphous phosphate coatings for aluminum. These two types of coatings are now in the development stage. Laboratory and field tests are being conducted, results are being evaluated, and modifications in chemical makeup and process sequence are being made to meet requirements. Several field tests, however, have indicated that they will do the same job for tantalum and aluminum processors as the other types of coatings have done for those working carbon steel, stainless steel, high-nickel alloy, and zirconium.

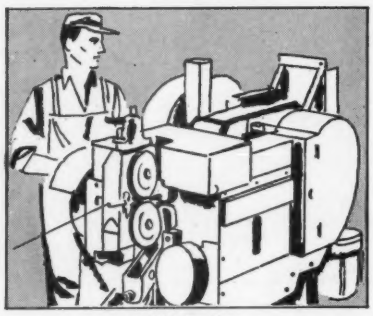
For more information write us at Ambler.



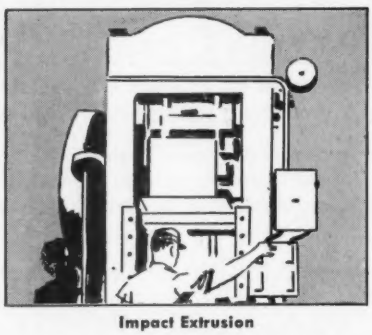
Tube Drawing



Wire Drawing



Cold Heading



Impact Extrusion

Note. Granodraw and Granolube are registered trademarks of Amchem Products, Inc.

Amchem Products, Inc. Ambler 30, Pa.

Formerly AMERICAN CHEMICAL PAINT COMPANY

CHEMICALS ACP PROCESSES

DETROIT, MICH. • ST. JOSEPH, MO.
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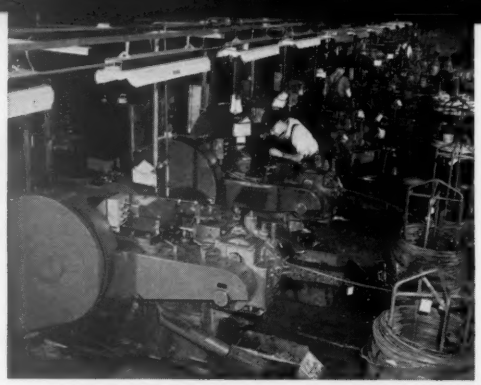
New Chemical Horizons for Industry and Agriculture



Wire drawn from Youngstown Hot Rolled Wire Rods being fed to a battery of cold-headers at Townsend's New Brighton, Pa., plant that are turning out "advanced design" fasteners for use all over the world.

Accent on Excellence

Youngstown cold heading quality rods

Townsend

As product assemblies must continually improve to keep competitive—the fasteners which hold them together must also be of the highest quality and of the most advanced designs.

To maintain their world-wide reputation for fasteners with "a view to the future", Townsend Company of New Brighton, Pennsylvania uses Youngstown's Cold Heading Quality Rods. They require rods that will produce fasteners with improved tensile strength, fatigue and shock resistance, and surface finish.

Wherever steel becomes a part of things *you* make, the high standards of Youngstown *quality*, the personal touch in Youngstown *service* will help you create products with an "accent on excellence".

THE
YOUNGSTOWN
SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel, Youngstown, Ohio

ALL NEW SHUSTER 2AV

variable speed – electrically controlled Wire Straightening and Cutting Machines

9 WAYS BETTER

1. Higher speed five die straightening arbor, mounted on ball bearings for minimum vibration.
2. Wide range Reeves Variable Speed 50 to 200 F. P. M.
3. Electric Brake on clutch shaft.
4. Totally enclosed feed roll housing with shafts mounted on Timken Bearings. Gears in oil.
5. Machine totally enclosed with guards.
6. Electric control Panel – one position operation.
7. Electric trip mechanism on target.
8. Solenoid-operated roll-type clutch.
9. Wire size range:
   1/16″ to 5/16″ mild steel wire.
   1/16″ to 3/16″ high tensile wire.

The BEST is *STANDARD* with SHUSTER!

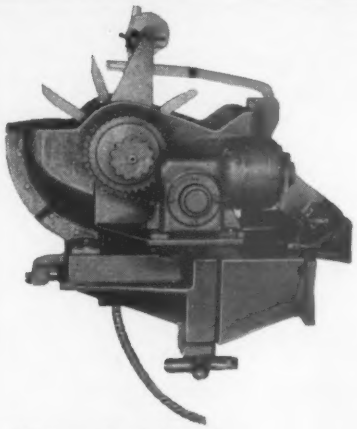
THE SHUSTER 2AV wire straightening and cutting machine (illustrated) includes 9 features as STANDARD EQUIPMENT. These features are your key to fast, accurate and economical production . . . they are furnished as STANDARD equipment on 18 of the 23 models manufactured by Mettler.

In addition, the new 2AV automatically cuts lengths up to 14″ at the rate of 140 pieces per minute, without use of clutch, when selector switch on new control panel is set on "Hand" position. The 2AV also provides *infinite* variable speed within all feed and cutoff ranges.

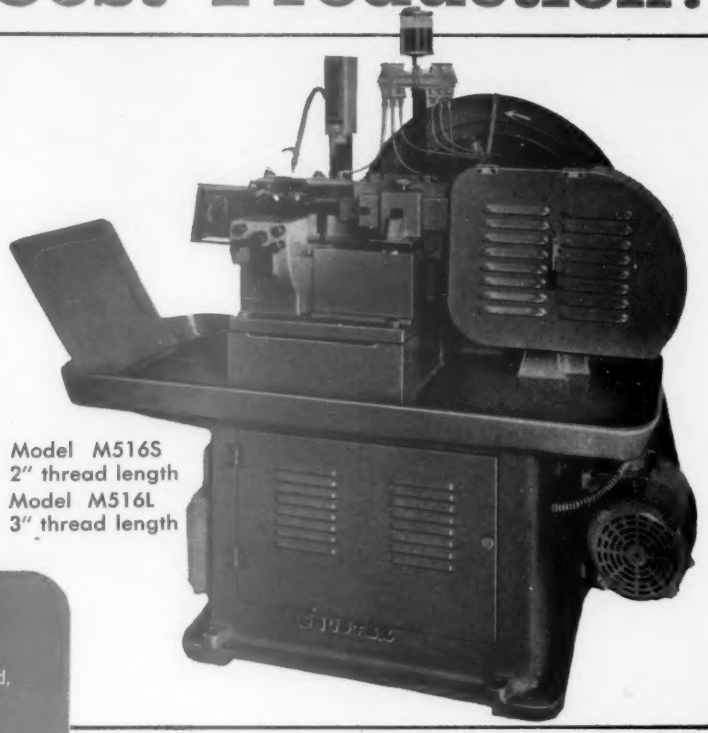
All rotary-type SHUSTERS may be supplied with interchangeable 12-roll, central foot straightening accessories for shape stock.

A wide variety of SHUSTER machines are available for straightening and cutting wire from .020″ to 3/4″. Tell us your requirements. Let us prove to you that a SHUSTER pays for itself faster than any other machine.

NEW SHUSTER
Thread Rolling Machines
for Low Cost Production!



Hopper Feed Models
H516L and H516S



Model M516S
2" thread length
Model M516L
3" thread length

SPECIFICATIONS

- 3/32" to 5/16" diameter thread, ferrous
- 2" or 3" maximum lengths
- Manual or Hopper feed
- Four models
- 60-100 pieces per minute
- 3 H P Motor or U.S. Varidrive

PRODUCTION PARTNER to the famous SHUSTER Wire Straightening and Cutting Machines!

Low Cost thread rolling is *now* available! Here is a brand new, thoroughly tested, compact and rugged machine for both the small and large producer.

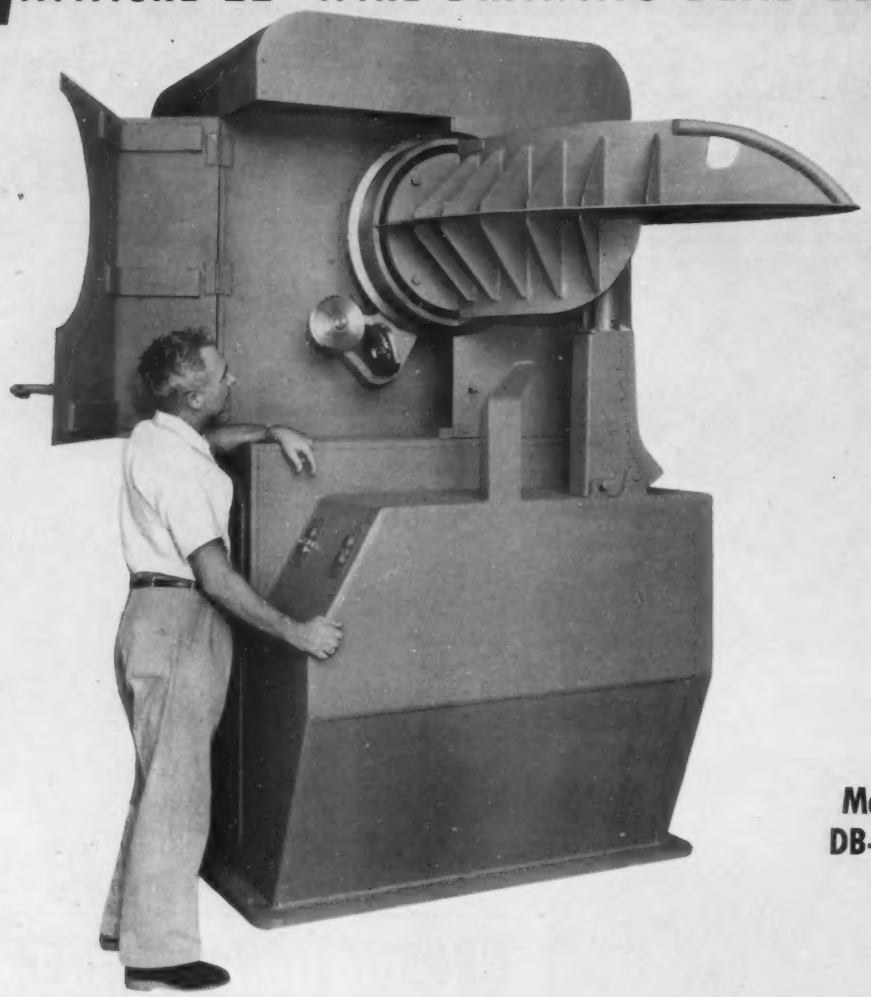
The SHUSTER Thread Roller offers you all the flexibility of production that different dies will allow, at extremely low initial investment. Complete details and prices available on request.

See SHUSTER'S Production Partners at the Metal Show — Booth #2750

METTLER MACHINE TOOL, INC.

155 West Adeline Street, New Haven, Conn.
Representatives in all principal cities.

WHITACRE 22″ WIRE DRAWING DEAD BLOCK



Model DB-22A

Continuous Production—Efficiency Approaching 100%

Gives you these advantages

Continuous increased production achieved by: • No down time for stripping • Permits packaging into stationary container or uninterrupted palletizing on stems • No tangling nor snarling from handling • Design simplicity. No back-gearing nor similar mechanisms • Greatly reduced floor space requirements • Dies in supplying drawing machine can be changed without stopping dead block • Accumulation type machines can be "run down" without stopping dead block • Continuous inspection and sampling • Breaks welded in production — low scrap loss • Increased production with lessened operator fatigue • Maintenance eliminated except for occasional lubrication of four main bearings and two motor bearings • Dead block can be located anywhere with wire literally piped from wire drawing machine • Extra large packages for in-process wire • Greatly reduced handling and in-plant transportation costs • Low capital investment.

OTHER MODELS AVAILABLE

16″ Wire Drawing Dead Block, Model DB-16A • 26″ Wire Drawing Dead Block, Model DB-26A • Combination 16″ and 22″ Galvanizing or Tinning Dead Block Take-ups, Model GB-2216A • 26″ Heavy Wire Galvanizing or Tinning Dead Block Take-up, Model GB-26B.

Write Today For Specifications And Name Of Nearest Distributor

WHITACRE ENGINEERING & MANUFACTURING COMPANY

5649 ALHAMBRA AVENUE • LOS ANGELES 32, CALIFORNIA • CAPITOL 5-2476

WHITACRE

FORMVAR... the industry standard

For more than 15 years Formvar resins have been the standard ingredient for magnet wire insulation enamels. Why such an outstanding history of success? Because enamels based on Formvar have an unsurpassed balance of properties which meet the rigid requirements of all phases of magnet wire insulation.

For the enamel manufacturer, Formvar resins are easy to compound. And Formvar based enamels meet the demands of: *enamellers* who require a smooth coating that is easy to apply; *motor manufacturers*, for an enamel that withstands the terrific punishment of automatic winding; and *motor users* who require a motor that stands up under severe operating conditions.

Formvar is the registered trade name for polyvinyl formal produced and sold only by Shawinigan Resins Corporation. When combined with an alkyl phenolic resin it becomes that tough, heat resistant wire enamel popularly known as Formvar enamel. More than 70% of all magnet wire used today is enamelled with phenolic modified Formvar.

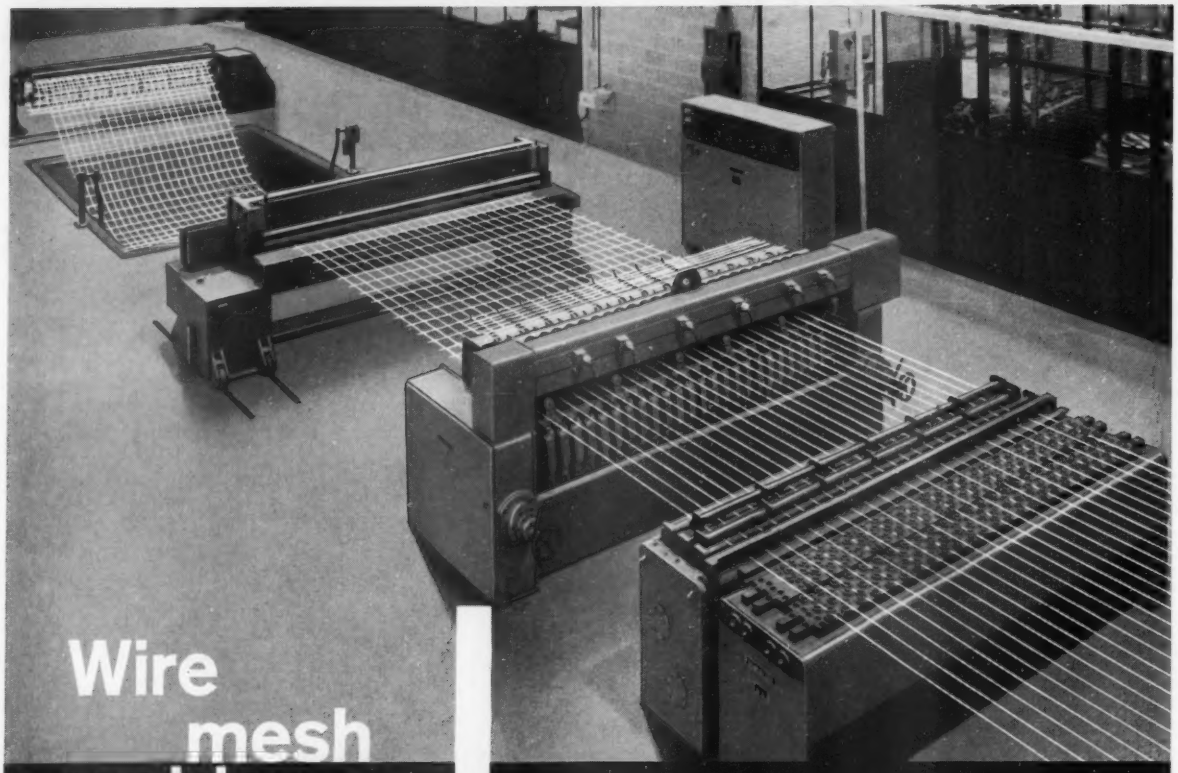
For wire insulations which permit trouble-free service, lower maintenance and production costs, and greater efficiency, look to enamels based on Formvar. Shawinigan's exacting production controls and active applications research keep Formvar a uniform and dependable ingredient for magnet wire enamels. Shawinigan Resins Corporation, Springfield 1, Mass.

SALES OFFICES: ATLANTA CHICAGO LOS ANGELES NEW YORK SAN FRANCISCO

FORMVAR®
polyvinyl formal by

SHAWINIGAN RESINS

"A recent North American Installation"



Wire mesh welder

for the manufacture of welded fabric sheets and rolls

Advantages of the welder

Quick change from one mesh size to another.
Infinitely variable cross and longitudinal wire pitch for any mesh dimension.
Minimum wear of the large-surface electrodes by suitable electrode shape and material, as well as efficient air cooling.
Maximum power factor of the transformers as a result of minimum inductive losses.
Three-phase connection to the mains supply. Electronic current switching by IGNITRON high-power tubes avoiding current surges.
No tearing of the welded mesh and no electrode burning when feeding bent cross wires since the welder stops automatically in such a case.
Effective cushioning of the carriage impact.
Minimum maintenance and servicing thanks to permanent lubrication of all gliding and rotating parts. Automatic oil fog lubrication of all air presses.
Automatic and interlocked sequence of operations and, therefore, always minimum duration of the total welding cycle.
Electrode pressure at every welding spot and feed power are infinitely variable.
Available with attachment for welding three different and preselectable cross wire pitches.

SCHLATTER

Representative for Canada and USA
P. REICHER - Machinery and Equipment
P. O. Box 127, Willowdale, Ontario, Can.

H. A. SCHLATTER LTD. ZOLLIKON/ZURICH
Manufacturers of electric welding machines (Switzerland)

Coulter & McKenzie D-PAKer shown above

EASY LOADING • EASY DISPENSING • EASY STACKING

Forget about the time and trouble involved in splitting, tying and wrapping wire! Continental's Payoffpak accommodates up to 100 pounds of fine wire as fast as it's drawn or annealed. This is the most practical—and most economical—way to pack, ship, store and dispense fine wire, ferrous or nonferrous. Superbly lithographed by Continental to do a real selling job for you, Payoffpaks are economically priced for one-time use. Call or write Continental *today*.

CONTINENTAL CAN COMPANY

Eastern Division: 100 E. 42nd St., New York 17
Central Division: 135 So. La Salle St., Chicago 3
Pacific Division: Russ Building, San Francisco 4

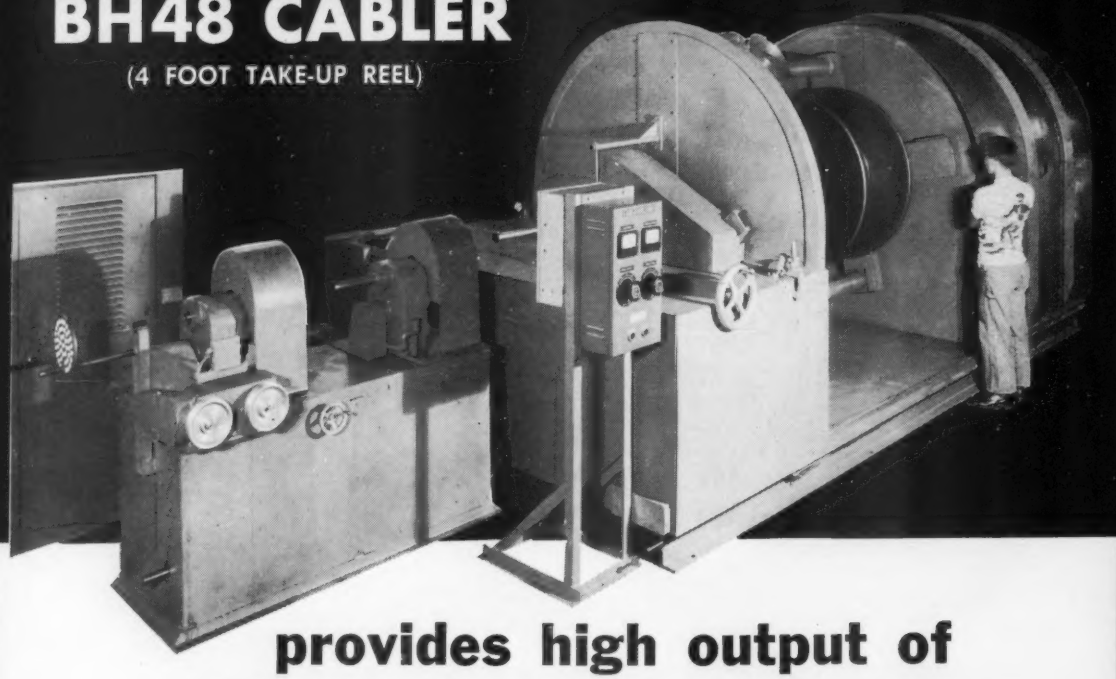
Payoffpak has a sturdy bail, smooth slick interior, and necked-in bottom for secure stacking. No need of reels or wide range of block sizes in filling . . . longer length of continuous strand means reduced downtime for your customers.

EITHER LUG OR RING SEAL TYPE CLOSURE PROVIDES TRUE AIRTIGHT SEAL!

new! COOK

BH48 CABLER

(4 FOOT TAKE-UP REEL)



provides high output of quality cable at lowest cost

The Cook BH48 is truly a speed demon! At 6" lay it will produce up to 12,000 feet per hour of the highest quality cable ever. That's production! And the Cook BH48 is versatile too. Two wires . . . a hundred wires . . . or more . . . the Cook BH48 will handle any number to make cable up to 1⅛" maximum diameter. That's versatility!

Whether you twist insulated wire, uninsulated wire, or both, you can count on the Cook BH48 for economy too. It's easier to string up (because it has no capstan), easy to operate (features simplified pushbutton controls), and is available with cotton, cloth, and paper wrapping attachments.

Want more information? Write today for the complete details.

SPECIFICATIONS

PRODUCTION:	12,000 ft/hr at 6" lay
FLYER SPEED:	400 rpm maximum
REEL SIZE:	48"F x 24"T x 22" barrel x 8" bore
FLOOR SPACE:	7'6" x 16'0"
LAY RANGE:	1½" to 18"
TWIST:	Right or left hand
FINISHED WIRE SIZE:	1⅛"
WRAPPING HEAD:	Optional
NEUTRALIZER:	Optional
Also Available in 36" and Other Sizes	

COOK

MANUFACTURING CO.

50 EAST 25th STREET, PATERSON, N. J. • ARMORY 4-6380

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CANADIAN AGENT

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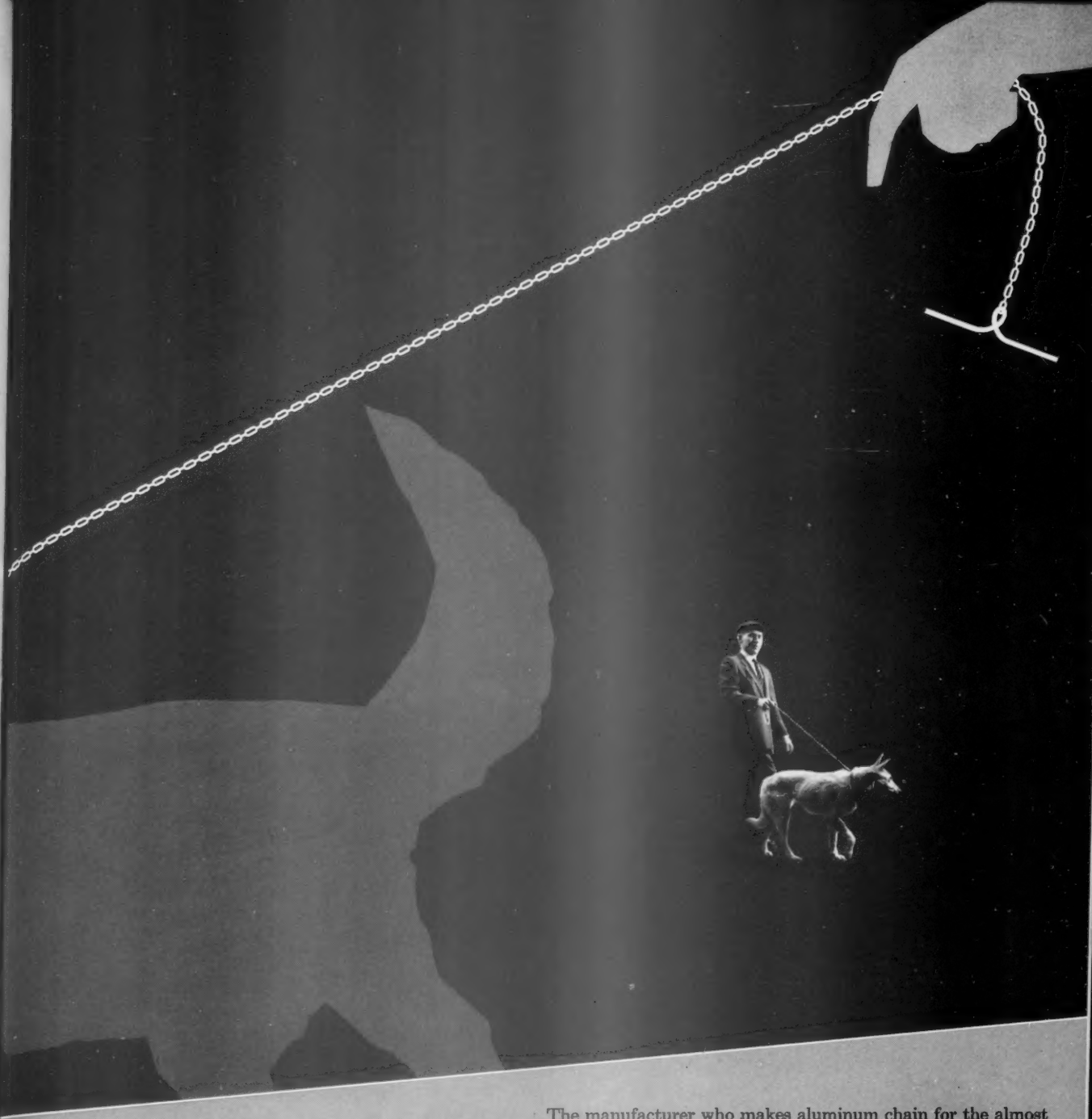
CAPAMADJIAN LE MONNIER CIE LTD., PARIS, FRANCE



a profitable idea!

The manufacturer who makes aluminum chain for the almost 50 million dogs and cats in the country is sure to win the business of millions of pet owners. A leash or "lead" of aluminum is light weight, corrosion resistant, strong, and can be anodized in beautiful colors. No matter what your wire product, it will pay you to check into the advantages of aluminum.

Alcoa has set up a special department to work with you on profitable new ideas, new uses for aluminum wire. For immediate action, write ALUMINUM COMPANY OF AMERICA, Wire Products Development, 1993-H Alcoa Bldg., Pittsburgh 19, Pa.

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

Your Guide to the Best in Aluminum Value

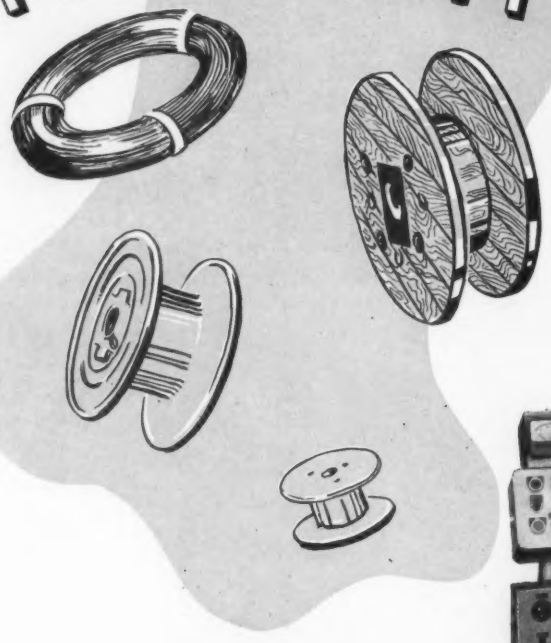
"ALCOA THEATRE" • Exciting Adventure • Alternate Monday Evenings

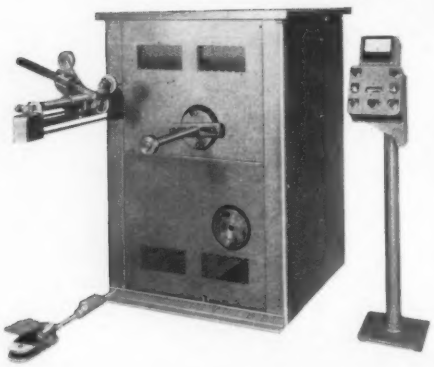
FLEXIBILITY *and Quality*

ALL ROLLED INTO ONE MACHINE

Top this off with performance and you have the Entwistle Model DS Respooler — Coiler for winding 7½" diameter spools, coils, non-returnable or 30" diameter shipping reels at speeds up to 1200 feet per minute.

Request Catalog Section 6A.





MODEL DS — Single upper and lower drive spindle with quick change reel adaptor.

MODEL DSAP — Single upper and lower drive spindle, power indexed double-head turret and interchangeable reel arbors and coiling head.

A PACKAGING GEM VERSATILE ENOUGH TO FILL THAT GAP ANYWHERE IN YOUR PLANT

Europe, South America, Mexico
FOREL EQUIPMENT CORPORATION
30 Church Street, New York 7, New York

ENTWISTLE
Manufacturing Corporation
1475 ELMWOOD AVE., PROVIDENCE 7, RHODE ISLAND
Over 40 years of dependable service to the Wire Industry

British Associates
THE KEMSON ENGINEERING CO., LTD.
Wellington Mill, Bolton Road
Blackburn, Lancs., England.

KEYSTONE MB SPRING WIRE STUDY

KEYSTONE MB Spring Wire Quality pays off for ROCKFORD SPRING Company

AUTOMOTIVE HEADLIGHT SPRING
"Saves customer $35,000 per year"

COMPRESSION SPRINGS
"Have to be good—if they fail, engines fail"

EXTENSION SPRINGS
"Uniform quality wire necessary for quality springs"

TORSION SPRINGS
"Quality wire is paramount"

These are a few reasons why Rockford Spring Company, Rockford, Illinois, prefers Keystone MB Spring Wire. And there are more, as explained by Burdette R. Steadman, General Manager: "We have found Keystone's metallurgical staff helpful in working out our design problems. The physical properties of Keystone Wire are held very close, and so it is possible to achieve even temper and even length. Rejects are negligible."

Consistent uniformity of composition, temper and diameter is necessary for quality spring production. Keystone MB Spring Wire is also available in drawn galvanized and copper coated finishes, as well as spheroidized annealed temper.

Your Keystone Wire Specialist and the facilities of our metallurgical department are at your service to help solve your wire problems.

Keystone Steel & Wire Company, Peoria 7, Illinois

KEYSTONE

WIRE FOR INDUSTRY

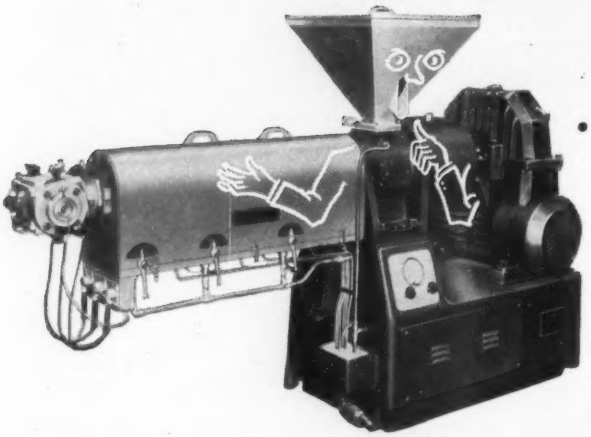


Illustration shows 3½" screw Plastics Extruder with cable sheathing die head. Extruders are available with smaller and larger screws for both plastic and rubber extrusion, and can be fitted with various types of heating and cooling systems as preferred or necessary.

..Generally speaking

....all extruders are

general insofar as they continuously produce lengths of plastic or rubber to some required shape, form or section. "General" extruders, however, have exceptional features both in design and performance; the design being the result of nearly forty years' experience in drawing-up and making highly specialised machinery and plant; and performance the result of lively and enthusiastic minds with a keen appreciation of engineering requirements and possibilities. At General Engineering Company we specialise in equipment for the electric cable manufacturing industry, where the plastic insulation of cable by extrusion is rapidly becoming more widely used, in high vacuum pumps and plant, and in all types of equipment for the impregnating of electric cable, transformers and other electrical products. This is not to say that our experience and products are solely applicable to these fields of industry. The extruders, for example, designed initially for the exacting duties of cable insulation, can easily be adapted for tubular, sheeting, or any special section application.

Again, the specialised knowledge of high vacuum techniques necessary for most impregnation processes is equally useful applied to any other process involving high vacuum. As a matter of fact the uses of this technique in industry and in the medical world are becoming very widely recognised and we have ourselves manufactured and installed plant for many differing types of work in various parts of the world. "Zeta" the experimental plant designed to gain control of released thermo-nuclear energy has one of our vacuum pumps fitted.

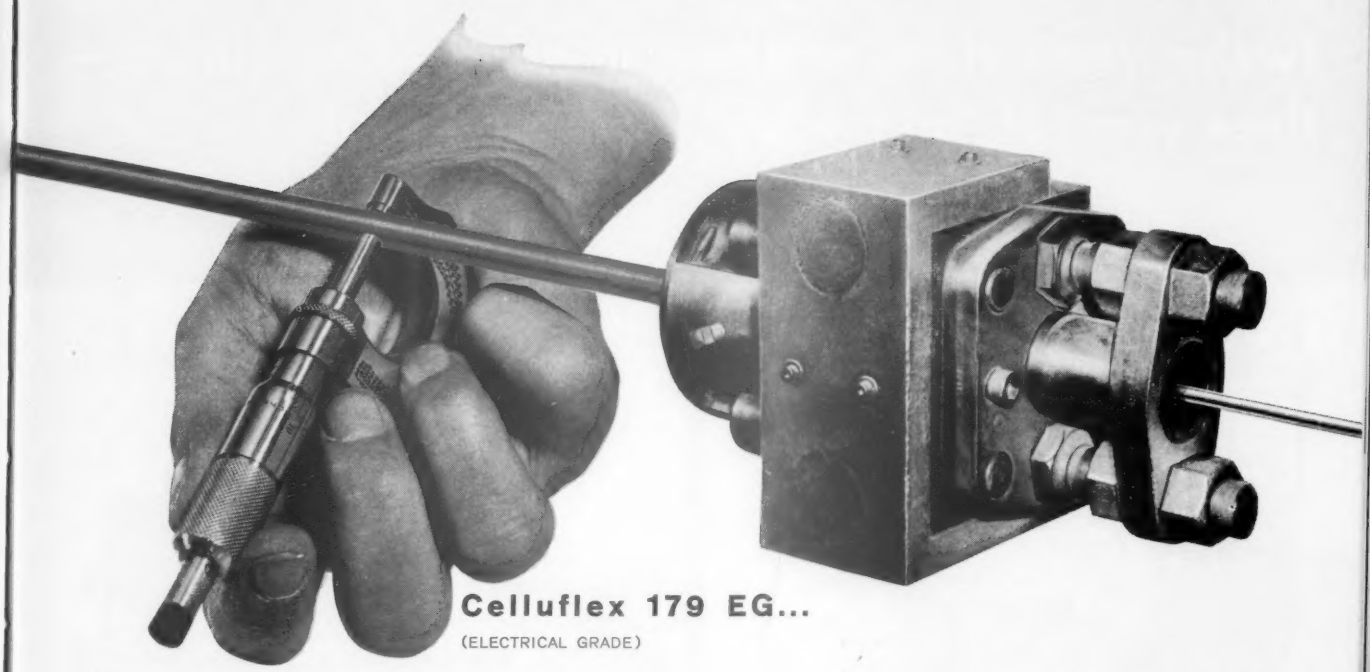
So, although we may be known to be active in certain fields of industry, we may also be able to put our experience at your disposal in some other connection —write or phone any of the addresses below. We shall be very happy to investigate your requirements.

General Engineering Company (Radcliffe) Limited

Station Works, Bury Road, Radcliffe, Lancs., England

Telephone: Radcliffe 2291 (4 lines) Telegrams: "General", Radcliffe, Manchester

Represented in nearly every country in the world



Celluflex 179 EG...

(ELECTRICAL GRADE)

selected for dependability and ease of processing

... add excellent volume resistivity, low volatility, fire resistance, excellent solvating action, oil and water resistance ... result: a tricresyl phosphate specially developed for the wire and cable industry for application in vinyl coverings.

Celanese is an expanding source for plasticizers for many jobs. Shipments from convenient distribution points are ready to meet tight schedules. Write Celanese Corporation of America, Dept. 590-S, Chemical Division, 180 Madison Avenue, New York 16, N. Y., for complete information. Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Avenue, New York 16, N. Y.

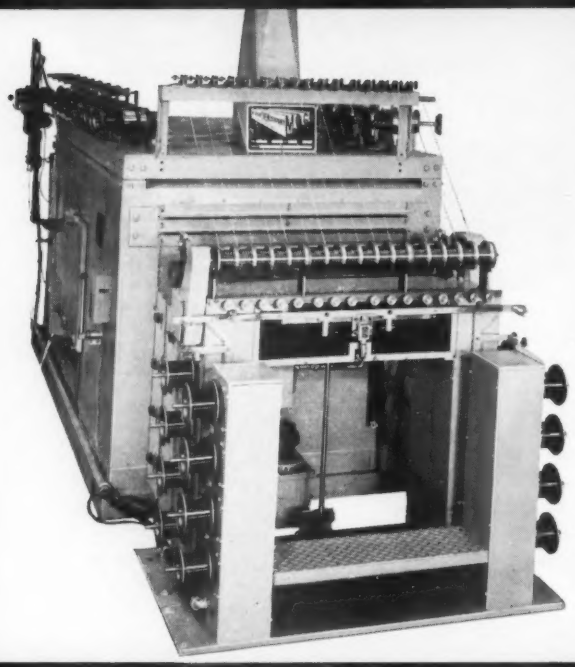
Celanese® Celluflex® Lindol®

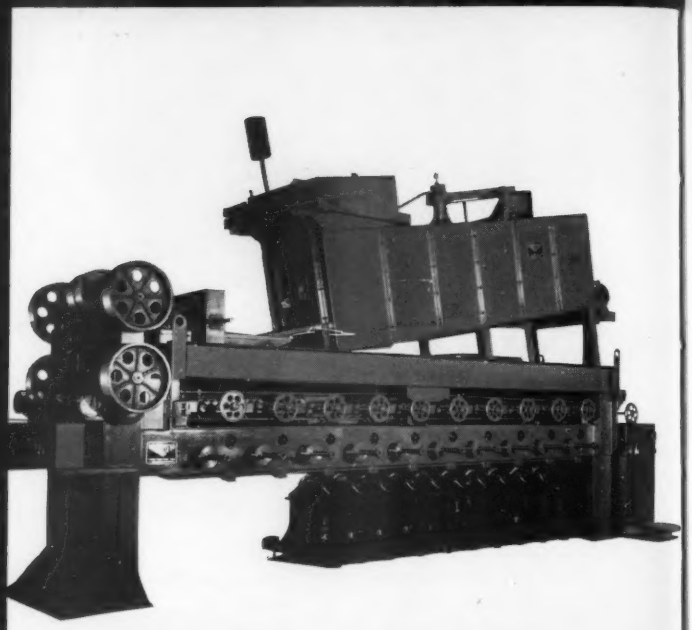
Celluflex 179 EG ... a Celanese CHEMICALS plasticizer

Call Celanese for: Tris-beta Chlorethyl Phosphate ... *CELLUFLEX CEF;* Epoxy Plasticizers ... *CELLUFLEX 21 and 23;* Four grades of flame-retardant Tricresyl Phosphate ... *LINDOL (low color)* ... *CELLUFLEX 179A (low specific gravity)* ... *CELLUFLEX 179C (general purpose grade)* ... *CELLUFLEX 179EG (electrical grade);* Cresyl Diphenyl Phosphate ... *CELLUFLEX 112;* Dibutyl Phthalate ... *CELLUFLEX DBP;* Dioctyl Phthalate ... *CELLUFLEX DOP;* Triphenyl Phosphate ... *CELLUFLEX TPP.*

EXPERIENCE:

Twelve years of development in gas-fired equipment — Three years of "on-the-job" production results





WIRE ENAMELING MACHINES

Typical of the complete line is this type "B" machine which handles wire from 31 A.W.G. to 42 A.W.G.

Five other models complete the range from the finest through large rectangles. The horizontal, high volumetric, recirculating double-pass oven allows greatly increased production by rapid heat impartation and a high degree of temperature uniformity throughout the wire chamber. Other features include: a catalyst within the recirculating stream consumes solvents and releases heat energy, individual clutches in each head of the wire capstan, automatic braking device controlling wire tension.

CONTINUOUS BRIGHT ANNEALERS

This is the first direct gas-fired annealer using the heating equipment as an internal inert atmosphere generator. Advanced mixing and burning equipments are utilized which exclude the need for external sources of steam or costly inert atmospheres. They are available in horizontal or vertical mounting positions. MOCO Annealers are of the high volumetric recirculating type with automatic air-fuel gas ration maintained over the entire range. They have a water sealed exit. No external source of inert atmosphere is needed.

WIRE ENAMELING DIVISION

MICHIGAN OVEN COMPANY

425 Brainard • Detroit 1, Michigan

MAXIMUM OPERATING TEMPERATURE	SYLVANIA WIRE
( ) 1300°F	1. Silver Plated Copperweld
( ) 1100°F	2. Kulgrid® 28
( ) 1000°F	3. Nickel Plated Copper
( ) 650°F	4. Silver Plated Copper
( ) 400°F	5. Oxalloy* 28
( ) 400°F	6. Inconel Clad Copper

*Trade-mark

Can you match these Sylvania *High Temperature Wires* with their applications?

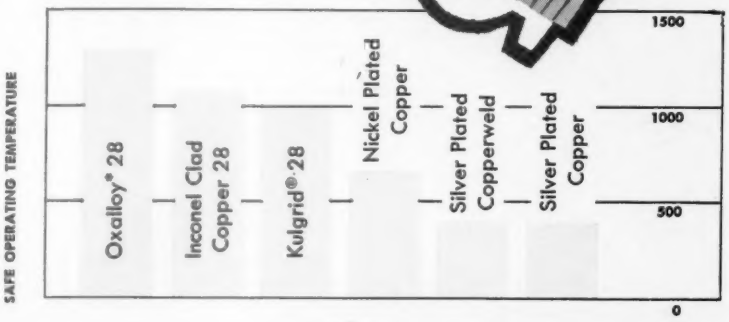
GET THEM ALL RIGHT? Then you're right up to date on Sylvania composite wires for high-temperature applications in corrosive and oxidizing atmospheres where good conductivity is required. (You can check your answers with the chart below.)

You may be interested in knowing, too, that new wires are under development, improving the conductivity and corrosion-resistance of plated and clad wires to operate in various ranges from 500° F to 2000° F.

A new "barrier" layer concept, improved coatings, and new composites such as aluminum-clad copper indicate the amount of effort and importance Sylvania places on its high-temperature wire development program.

If you're not yet completely familiar with Sylvania High Temperature Wires, write for your "Product Bulletin." As a major supplier of both clad and plated wires, Sylvania is in a unique position to offer objective recommendations on the best wire for your application. Address your inquiry to

SYLVANIA ELECTRIC PRODUCTS INC.,
Parts Division, Warren, Penna.



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LIGHTING · TELEVISION · RADIO · ELECTRONICS
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PARTS DIVISION

Custom Molded Plastics
Custom Metal Stampings
Custom Welded Parts
Alloy, Clad, Plated Wire
Plated Metal Strip
Electronic Components
Fluorescent Components

Wire for 10,000 uses

...and we make all kinds

Name your wire requirements—chances are that our wire mills at Johnstown, Pa., and Sparrows Point, Md., are right now producing the very grade you need.

Whether it's low- or high-carbon wire, bright basic or annealed, galvanized or bethanized . . . we pay the closest attention to all the important details that mean top-quality steel wire.

Working closely with users of steel wire, we have developed various specialties for specific end uses. Our engineers will gladly discuss steel wire with you, whether you need an ordinary grade or something special. Just get in touch with the district sales Bethlehem office nearest you, or write to us direct.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

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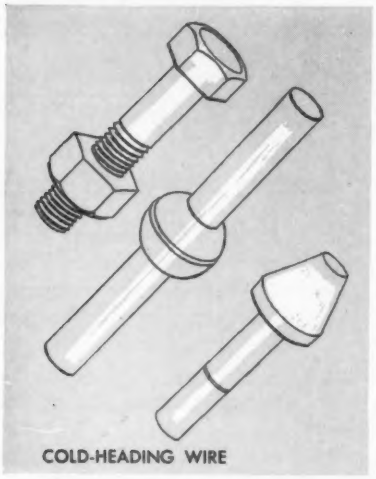
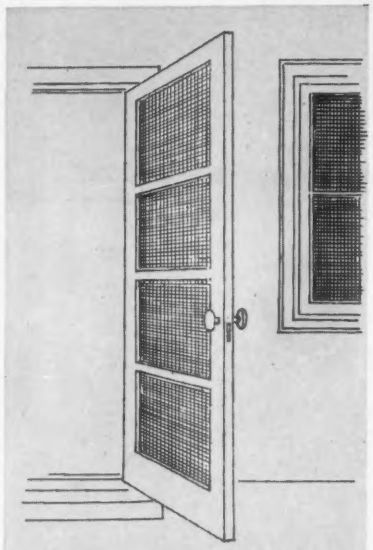
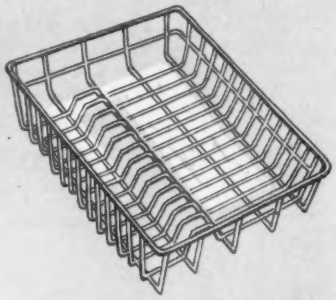
Export Distributor:
Bethlehem Steel Export Corporation



COLD-HEADING WIRE

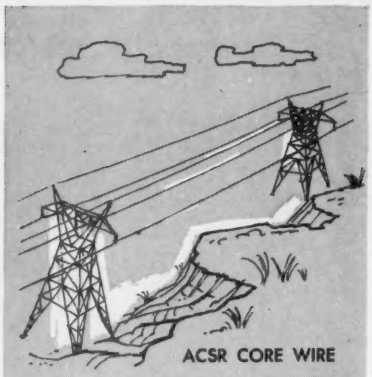


LIQUOR FINISH FLY SCREEN WIRE

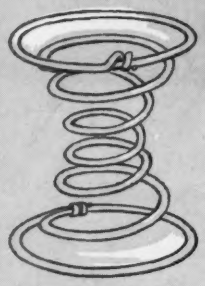


BRIGHT BASIC WIRE

COAT HANGER WIRE

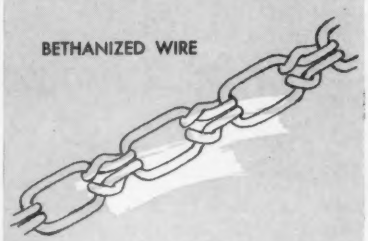


ACSR CORE WIRE

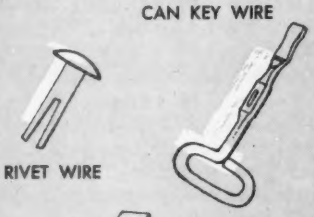


SILVER STAR SPRING WIRE

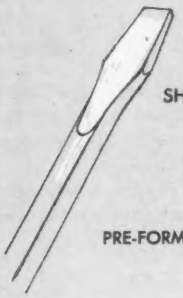
BETHANIZED WIRE



CAN KEY WIRE



RIVET WIRE

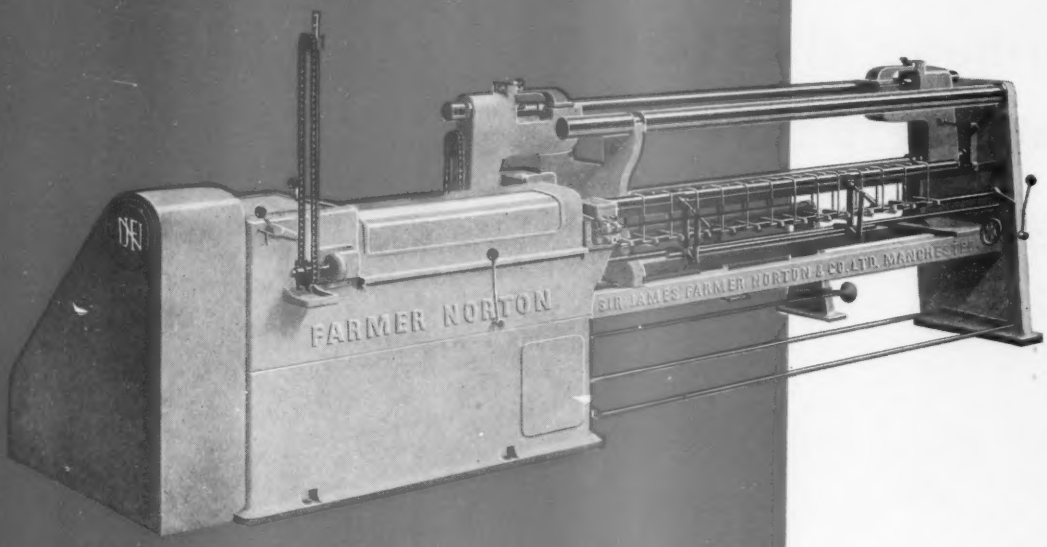


SHAPED WIRE

PRE-FORMED STAPLE WIRE

BETHLEHEM STEEL

BETHLEHEM STEEL



Farmer Norton

CHAIN LINK WEAVING MACHINES

Incorporating the NEW Blashill gear box

MARK 1. Width up to 7 foot maximum fence.

MARK 2. Width up to 12 foot maximum fence.

Capacity from 6's to 14's gauge wire in 1¼" to 4" meshes.

Practical output on suitable wire: 2" mesh on 4 foot netting height up to 1750 square feet per hour.

SIR JAMES FARMER NORTON & CO. LTD.

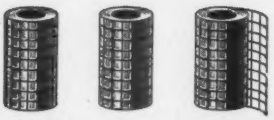
ADELPHI IRONWORKS, SALFORD 3, MANCHESTER, ENGLAND

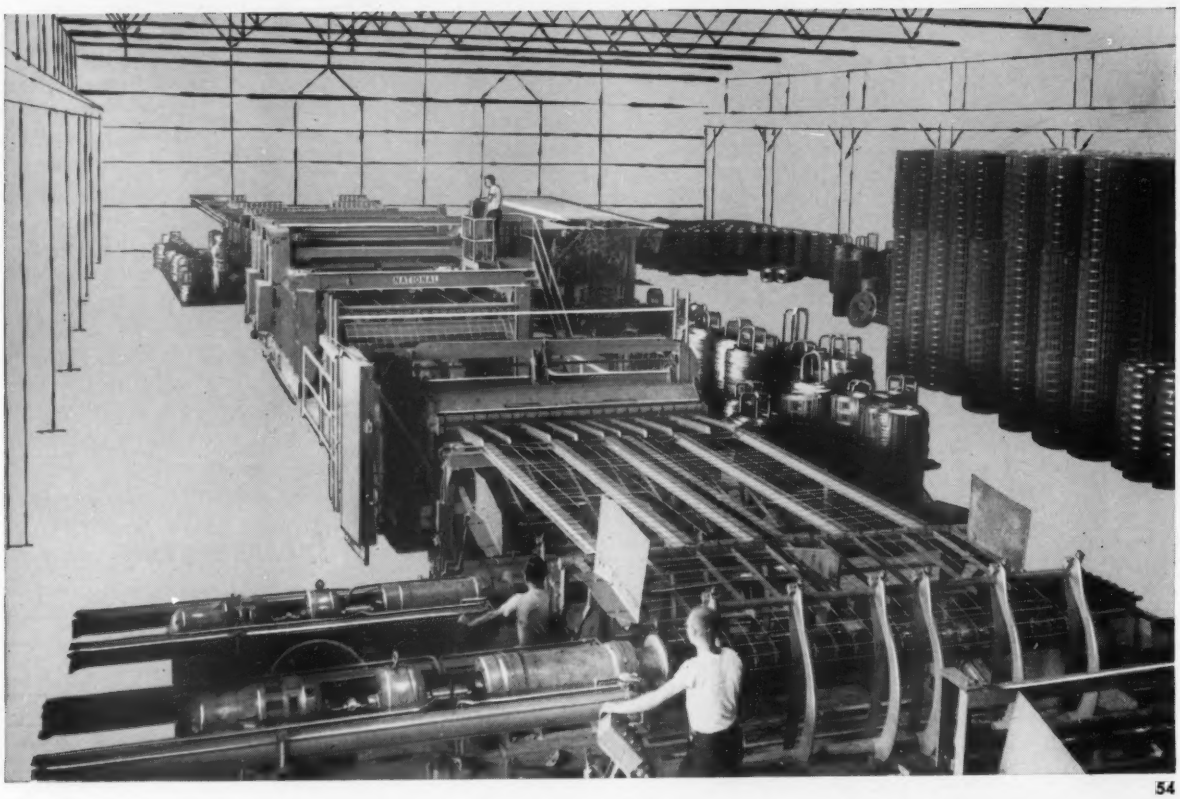
PHONE: BLACKFRIARS 3613-4-5

GRAMS: AGRICOLA, MANCHESTER

MAKERS OF WIRE DRAWING, WEAVING MACHINES AND ACCESSORIES

wire fabric produced at amazing speed with a four-head **NATIONAL electric unit**





54

160 to 200 feet of 6" x 6" wire-mesh fabric a minute is now being produced by National Electric's newest four-head fabric welder. This amazing speed and the resulting economy is achieved with two dual welding units welding four cross wires simultaneously. The machine welds 22 number 6 gauge, longitudinal wires to 4 number 6 gauge cross wires at one time. Its speed is adjustable from 30 to 60 operations per minute. Components of the new welder include a longitudinal wire straightener and base assembly, four welding heads, mat puller and indexer and a shear. Since the finished fabric may be 120 inches wide in a single width, or in two widths of 60 inches, a special dual coil winding system is incorporated.

National Electric designed this wire mesh welder to meet the specific needs of an individual customer. If you have a volume welding operation, whether it be on home laundry equipment, automotive muffler shells, or jet engine parts . . . the chances are it can be done faster and more economically with an automatic welding unit engineered and built for you by National. Write for complete information.

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YOU SAVE ON WIRE INSULATION COSTS WITH THE NEW BLANE COMPOUND #2105!

- Blane Compound #2105 comes pelletized ready for extrusion in natural and all standard colors.
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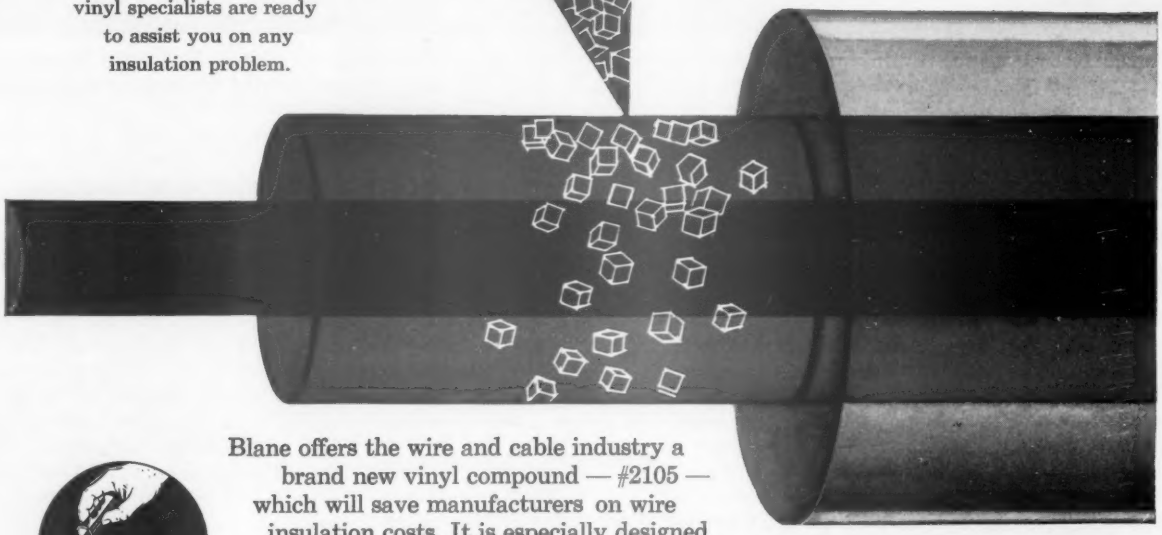

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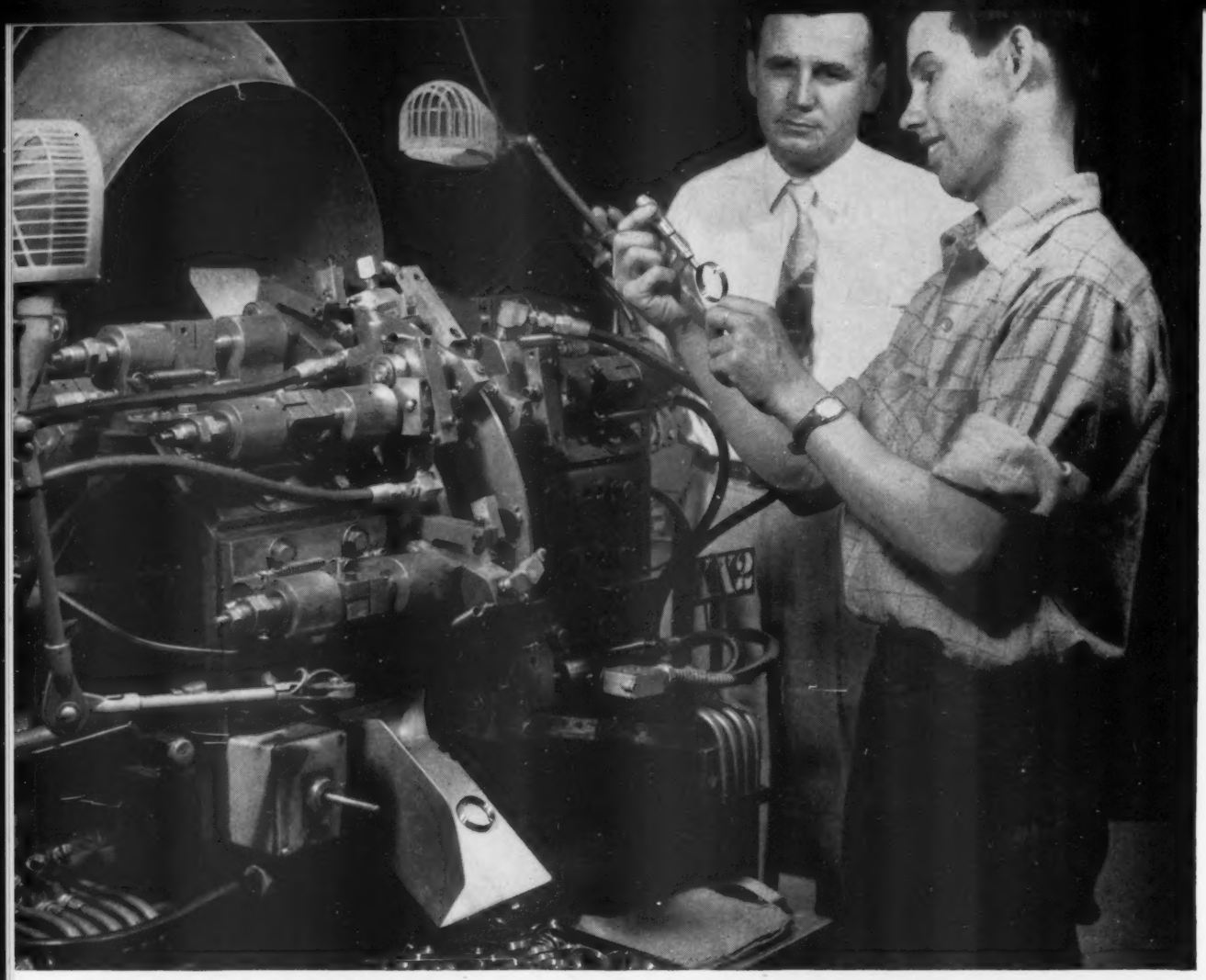


William Kody, American Coil Spring sales manager, watches as important product receives periodic check. An automobile window regulator clutch spring, it must be very precise. Johnson music spring wire fits product and machine.

Johnson Music Wire meets the test at American Coil Spring Company where . . .

Automation Demands Uniform High Quality

When American Coil Spring Company needed a precise music spring wire for an exacting auto window regulator spring, past experience prompted it to turn to Johnson Steel & Wire Company, a leading producer of high-carbon fine-specialty wires.

And when the same company—for 32 years one of the nation's top precision springmakers—was looking for ways to further automate its Muskegon, Mich., plant, Johnson came up with another answer—extra-sized coils of weld-free music wire to reduce machine downtime and wire handling.

One of the largest spring wire users in the United States, American Coil has a company watchword—Springs With a Pedigree. Everyone at American Coil lives up to this slogan by constantly emphasizing quality in every phase of production. This has paid off for American Coil by building a reputation for making the best of standard springs—and special springs others can't make.

Every bit of American Coil's skill comes into play on the auto window regulator spring. The spring has to have perfect diameter because it is mechanically inserted in the window clutch during an automatic assembly. Too large, and the spring won't fit. Too small, and it will cause slippage when the window is raised or lowered. Either variation in dimension will cause rejection.

To make the spring, which has three turns and is close wound with extended legs bent opposite, American Coil invented a special machine to combine the coiling and bending operations.

One-half of the challenge solved by the machine, American Coil then had to find a superior wire. Cast and peak had to be exactly as specified. Uniform dimension of .055″ X-L-O music wire had to be held, both within the coil and from coil to coil. Excellent surface was another must. Johnson's X-L-O music wire met these specifications readily. It is available in a full range of sizes between .003″ and .300″ and can be given a number of phosphate or other surface coatings.

Meeting this customer's requirements through ingenuity and good wire is a formula American Coil applied in the case of the extra-sized coils.

Springs are periodically projected onto the screen of this shadowgraph so that minute details of their conformation are compared with drawings.

Operator prepares for a run of springs for automatic bowling alley pin setters. The Johnson music spring wire that feeds this machine comes in a special 500 lb. bundle so that run will be twice as long. Downtime is reduced.

American Coil is committed to a policy of automating wherever possible. In springs requiring Johnson's .080" and larger music wire, Johnson doubled coil sizes from the traditional 250 pounds to 500 pounds without welds. This reduced storage space, simplified handling and reduced downtime on the coiling machines. Moves like this permit American Coil to achieve a daily capacity of 18 million pieces with a labor force that numbers usually 350 people.

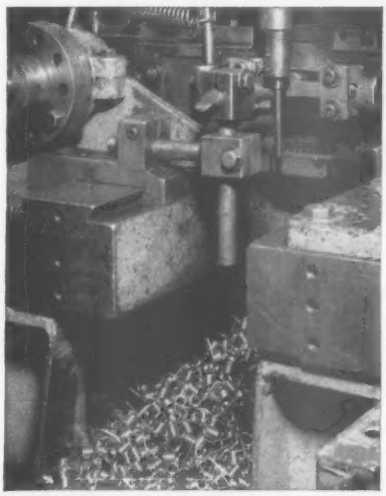
Of the relationship between American Coil and Johnson, Works Engineer James Church of American Coil says:

"The combination of our experience in springmaking and Johnson's superior knowledge of wiremaking, results in a highly successful product."

All these advantages of Johnson's wire are available to you, no matter whether you need music wire or any of the other specialties—

Aircraft Cord Wire . . Armature Binding Wire . . . Belt Hook Wire . . . Bobby Pin Wire . . . Brush Wire . . . Gutterbroom Wire . . . Card Wire . . . Shade Roller Wire . . . Flexible Shaft Wire . . . Heddle Wire . . . Hose Reinforcement Wire . . . Hose Wire . . . Mandolin Wire . . . Piano Wire . . . Rope Wire . . . Safety Pin Wire . . . Special Shaped Wire . . . Staple Wire . . . Metal Stitching Wire . . . Signal Corps Wire . . . MB Spring Wire . . . Tire Bead Wire.

If you have an application which requires high quality and close tolerances, Johnson is ready to serve you. Call your closest district office today.



Nobody watches this machine as it produces thousands of perfectly duplicated springs. If the wire were not highly accurate in dimension and metallurgical characteristics, frequent adjustments would be necessary.

Testing for tension is a constant operation at American Coil Spring. Variations in wire quality would show up here. American is well satisfied with Johnson music wire quality.

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Worcester 1, Massachusetts

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*Per Pound of Wire

The Wire Outlook

Government economists are united in opinion that strong undercurrents are in motion leading toward an early emergence from the recession.

There are many straws in the wind to support this view. Stock market investors are betting on better business, reflected in stock prices that are out of proportion to current earnings. Steel production moved up steadily during the summer to an average in the neighborhood of 60%—as against 50% in the spring. Many large corporations showed better earnings in the second quarter. Consumers are registering confidence through a substantial increase in spending—particularly for such home appliances as fans, air conditioners, refrigerators, dishwashers, laundering equipment, and vacuum cleaners—all involving wire in their manufacture. And a number of copper and aluminum refineries have been re-opened.

Be that as it may, with the danger of a shooting war in the Mid-East greatly lessened, the signs all point to a steady betterment in general business conditions from now on through the year, although it is quite possible that there will not be a return to complete normalcy until well along in 1959.

An increase in orders for durable goods usually precedes an upturn in business activity. Whereas durable goods orders were $10.8 billions in April, they were $11.4 billion in May and $11.7 billion in June. Total new orders for all goods were reported by the Department of Commerce to be nearly 26 billion dollars in June as against 27.5 billions a year ago.

Inventory reductions, considered a major cause of the recession, continued through June, but there has been since some forward buying, partly as a hedge against higher prices and partly for increasing needs. Added to this, the Government's huge spending program for public works, road building and defense is getting under way, the effects of which will have a tendency to prime the pumps of business.

Unemployment is and will continue for some time to be a problem. In 89 out of 149 major labor markets, the number of persons without jobs amounts to 6 per cent. Nearly 65 million people were working in June, one million up from May, but 1½ million under June of 1957. This increase added $2 billion to the nation's personal incomes.

Steel, copper, aluminum and many other material prices have risen. Wages, too, are advancing. The recession somewhat slowed the trend toward higher costs, but did not stop the inflationary spiral. The raising of the national debt ceiling will have a long-range inflationary effect.

In addition to the foregoing, people are buying more homes and farmers in most sections of the country are doing better. Spending on new plant and equipment still lags, but the chances are that as the recovery gains momentum, some of the pigeonholed expansion plans will be brought out for re-consideration.

The public's reaction to the 1959 crop of motor cars will determine somewhat the speed of recovery. 1958 sales have been a major disappointment, the effect of which on general business has been marked. The industry's requirements for wire and wiring for the new cars has given some encouragement to many wire mills.

The wire industry has been quiet, active only in a few spots. June shipments of wire were higher than the earlier months—better than a year ago—and mill deliveries have been stretched to 3 weeks instead of 10 days. August volume is expected to show further improvement.

Merchant wire and wire products are more active than manufacturers' wire and, of course, construction requirements account for the largest wire tonnages. Spring wire is showing some activity and electric wire and cable is responding to construction needs. One large manufacturer reports the best orders in July since last October.

Improvement in business has undoubtedly been sparked by growing confidence. Recovery seems to be on the way and while all the marks of the recession have not been erased, the trend is in the right direction.

Edmund Duval Sickels
EDITOR

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When you attend the ANNUAL WIRE ASSOCIATION CONVENTION in ATLANTIC CITY October 13th through 16th, we hope you will visit us in the R. H. Miller Company, Inc., "STEELSKIN" suite at the Chalfonte-Haddon Hall Hotel.

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Vol. 33 SEPTEMBER, 1958 No. 9

The Drawing of Titanium (A55) and Titanium Alloy (C110M) Wire

by

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Associate Professor
Massachusetts Institute of Technology
Cambridge, Massachusetts

This study is concerned with deformation efficiency, drawability of the materials, lubricants and die angles.

Introduction

Titanium and titanium alloy wire find application, particularly in the form of welding rod. Although drawing problems have occurred, frequently associated with lubrication practice, reasonable solutions seem to have been made and substantial amounts of wire are processed.[1, 2] There is still much need, however, for basic engineering information on the role of such processing variables as die design, lubrication practice, pass reduction, and drawing speed in determining wire drawing characteristics. Experiments described below were undertaken to provide some of these data.

Experimental Procedures

Materials: Commercially pure titanium (A55) and the Ti-8Mn alloy (C110M) were taken from single heats to minimize any compositional effects (Table 1). Both were obtained as wire of 0.187-inch diameter cut into 3-foot lengths.

★ ★ ★

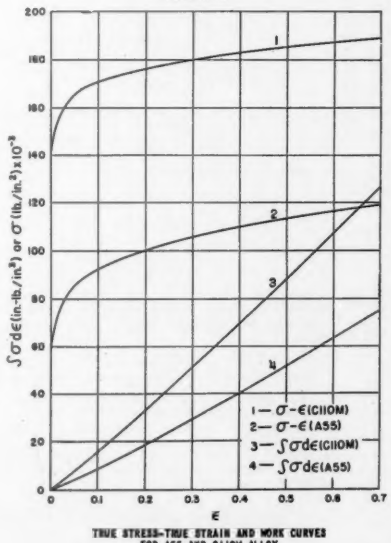
TABLE I

CHEMICAL ANALYSIS, WT. %

Material	C	N	Fe	Mn
C110M	.13	.014	.28	9.95
A55	.038	.025	.17	.01

For later treatment of experimental data, strain hardening characteristics under tensile loading were obtained in the form of true stress-strain curves with samples of each material.* These curves are plotted in Figure 1 (Nos. 1 and 2) along with two other curves of steadily increasing slope (Nos. 3 and 4). The latter give the area (in units of inch-pounds per cubic inch or pounds per square inch) under the corresponding stress-strain curves and so are labelled $\int \sigma d\epsilon$. These curves simply show the work per unit volume, $w_h = \int \sigma d\epsilon$ necessary for any pure tensile strain, ϵ, or reduction, r. All theories of wire drawing, from the most elementary to the most complex, are in agreement that for any specific strain or reduction the drawing stress, $\sigma_d = \int \sigma d\epsilon$ under

FIGURE 1



TRUE STRESS-TRUE STRAIN AND WORK CURVES FOR A55 AND C110M ALLOY.

the impossibly ideal condition of no friction and no "turbulent" or redundant straining in passage through the die (100 percent deformation efficiency).

★ ★ ★

Dies: For the manufacture of dies, carbide blanks were specially ground with a conical passage having essentially no bearing length at exit. Five dies were prepared, all with the same exit diameter of 0.093 inches. Accordingly, to vary drawing reduction, the starting wires were centerless ground to different initial diameters. The full conical die angle, α, differed in each die: values of 8, 12, 16, 20, and 24 degrees were chosen for coverage of conditions of possible practical interest. Such design with conical section and absence of bearing is not, of course, generally representative of practice. However, it is particularly useful in isolating effects due to the variable of die angle.

★ ★ ★

Drawing stress measurements: All wires were drawn using an Instron testing machine. Figure 2 is a schematic illustration of the experimental set-up. Wires were pointed by swaging to 0.092 inches diameter, hydrohoned to a standard surface condition, and then lubricated. The pointed end was next threaded through the crosshead and die into serrated pulling grips. Drawing force measured through the operation of a load cell was indicated by a tracing on a chart record. Division in all cases of this force by the unchanging exit cross section of 0.0068 square inches gave the drawing stress, σ_d.

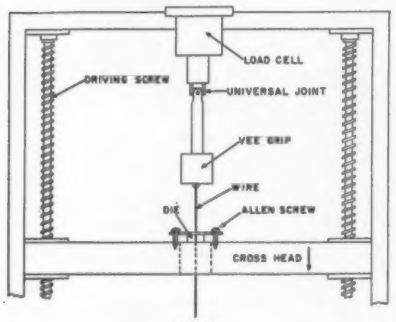


FIGURE 2
EXPERIMENTAL SETUP

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Speed of drawing was considered as one variable and a range of 0.02 to 20 inches per minute was covered. For each speed investigated, wire was drawn until a more or less steady load was indicated on the record. Then the test was interrupted while a simple gear change was made before pulling at another higher speed. Using this procedure, the effect of drawing speed on force requirement could be determinted with a single wire specimen.

★ ★ ★

Lubrication: Selection of lubricant was dictated in part by industrial practice[2], which indicated the superiority of a copper plate base coated with a metal soap. A number of lubrication procedures were also surveyed by drawing differently lubricated lengths of A55 with a constant reduction in one pass of 10 percent through a die of angle $\alpha = 16$ degrees, and at a fixed speed of 10 inches per minute. Drawing stresses with the various conditions of lubrication are listed in Table II. The stress range is broad, with the ratio of extremes being approximately 2½. The copper-plate zinc-stearate combination was selected for further study for the added reasons of low drawing stress under the experimental conditions and the absence of load fluctuation during pulling. Tabulated stress values for many of the procedures represent considerable averaging, the load varying as drawing progressed. For a second choice, expected on such grounds to be less satisfactory, the phosphate base plus colloidal graphite in water was selected.

TABLE II
DRAWING STRESSES WITH VARIOUS LUBRICANTS UNDER IDENTICAL TESTING CONDITIONS

(Material, A55 at 10% Reduction, drawing speed of 10 in/min, α = 16°)

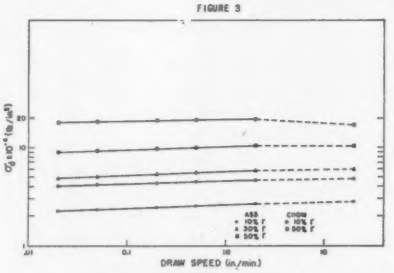
Surface Preparation	Application	Stress (1000 psi)
None	Mo S_2 - Lacquer	42.3
None	Mo S_2 - Grease	65.5
Phosphate*	None	53.9
Phosphate	Mo S_2 - Lacquer	40.0
Phosphate	Mo S_2 - Grease	31.3
Phosphate	Heavy Oil	42.3
Phosphate	Zn Stearate	28.2
Phosphate	Colloidal Graphite in H_2O	31.4
Anodized*	None	60.9
Anodized	Mo S_2 - Lacquer	37.6
Anodized	Mo S_2 - Grease	40.2
Anodized	Heavy Oil	36.3
Anodized	Zn Stearate	26.3
Copper	None	46.6
Copper	Mo S_2 - Lacquer	35.8
Copper	Mo S_2 - Grease	40.0
Copper	Zn Stearate	28.4
Copper	Colloidal Graphite in H_2O	25.5

*From recommended procedures contained in Battelle Memorial Institute final technical report (BIS 402/60-33) in connection with Contract No. DA-33-019-ORD-818.

Test Results

Speed Effects: Representative data illustrating the dependence of drawing stress on speed are given in Figure 3. Plotted on log-log coordinates, drawing stress increases but slightly with drawing speed, at a rate independent of reduction, to a speed of 2 inches per minute. In the next interval to the maximum speed of 20 inches per minute, the trend is altered and drawing stress in general increases less rapidly, even undergoing a decrease in some cases. The transition at about 2 inches per minute is reasonably attributed to a lowering of material strength by heat generated in drawing, which was evident by drawn wire being hot to the touch. At the highest speeds, transfer into the die of heat supplied by deformation work is least, and the wire accordingly acquires the highest temperatures, a condition aggravated by the low thermal diffusivity of titanium. To minimize any interaction of speed effects with the effects of changes

FIGURE 3



EFFECT OF DRAW SPEED ON THE DRAW STRESS
(Lubricant Copperplate plus Zinc Stearate, α = 16°)

* True Stress and true strain are found increasingly helpful in many metal working problems and definitions are perhaps now widely known. In review:

$$\text{true stress, } \sigma = P/A_1$$
$$\text{true strain, } \Sigma = \log_e A_0/A_1$$

where P, A_1, and A_0 are instantaneous tensile load corresponding area of cross section and the initial area of cross section, respectively. A reduction in area in wire drawing, $r = (A_0 - A_1)/A_0$, where A_0 and A_1 are initial and final area of cross section, respectively, is related to the equivalent true strain, Σ, by

$$\Sigma = \log_e \left(\frac{1}{1-r}\right)$$

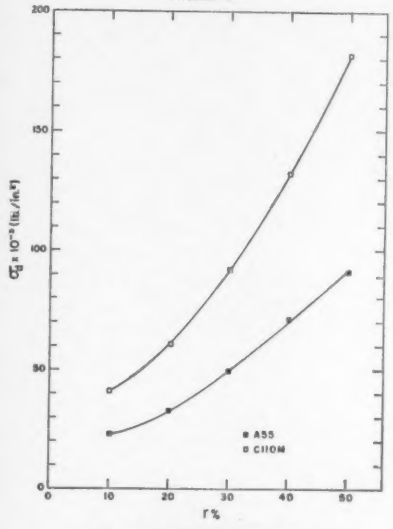
with $\log_e$ being the natural base logarithms.

in other processing variables, results reported below were obtained in tests made at a standard slow drawing speed of 0.02 inches per minute.

★ ★ ★

Other Processing Variables and Deformation Efficiency: The relationship of drawing stress to reduction is represented with some selected data in Figure 4 for both materials and $\alpha = 16$, degrees using copper-plate zinc-stearate lubrication. The trend is much like that previously observed for other materials.

FIGURE 4



EFFECT OF REDUCTION UPON THE DRAW STRESS
(Lubricant Copperplate and Zinc Stearate, Draw Speed 0.02 in./min, α = 16°)

A generally useful concept in the analysis of plastic working operation is that of deformation efficiency, η: the fraction of all work expended that is used in producing only the necessary shape change, which, in the present instance, is reduction from A_o (variable) to A_1 (fixed at 0.0068 square inches). Considering a wire of drawn length l_1, produced with an applied force F_d,

$$W_a = F_d x l_1 = \sigma_d = A_1 x\ l_1 = \sigma_d x V$$

where V is the total volume of drawn wire. Therefore, work per unit of volume for the particular reduction is simply $W_a/V = w_a = \sigma_d$. Now, as noted earlier, work required per unit volume for shape change alone is $w_h = \int \sigma d\epsilon$ (Figure 1). Therefore, by definition $\eta = w_h/w_a = \dfrac{\int \sigma d\epsilon}{\sigma d}$ must be less than 1 because unavoidable work is used up in overcoming frictional drag through the die and in producing some redundant deformation in undergoing the basic reduction from A_o to A_1. Deformation efficiency is readily calculated with the present data, simply by dividing values of $\int \sigma d\epsilon$ from Figure 1 by values of σ_d for the same reduction and taken from plots such as those in Figure 4. The results for many conditions are summarized in Figures 5, 6, and 7.

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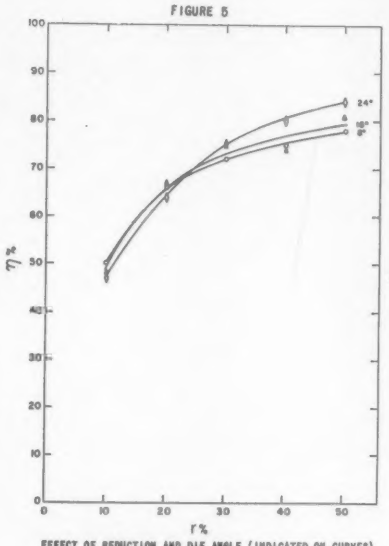
FIGURE 5



EFFECT OF REDUCTION AND DIE ANGLE (INDICATED ON CURVES) UPON THE WIRE DRAWING EFFICIENCY
(Material A55, Draw Speed 0.02 in./min, Lubricant Copperplate plus Zinc Stearate)

The trends displayed are again very similar to those encountered for a wide variety of other materials and drawing conditions, with levels, on the whole, actually being somewhat higher than normal. The absence of the die bearing section in the present experiments, which contributes to frictional losses, explains to a large extent the generally greater efficiency values.

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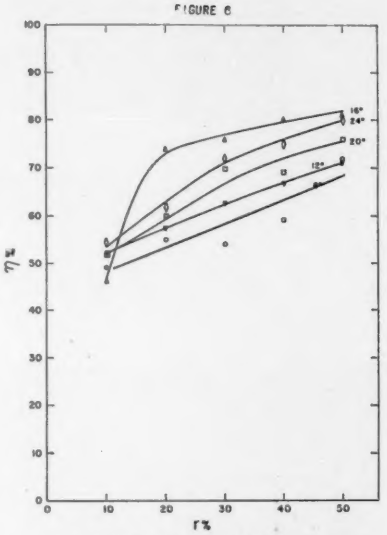
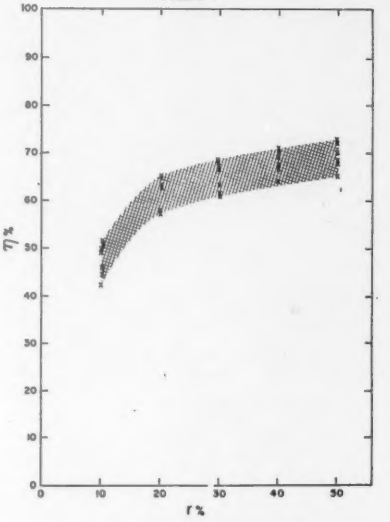
It is known from both theory and experiment that for constant reduction and lubrication practice, frictional work losses decrease while losses from redundant straining increase as α is made larger. Efficiency, therefore, is at a maximum for some intermediate

FIGURE 6



EFFECT OF REDUCTION AND DIE ANGLE (INDICATED ON CURVES) UPON THE WIRE DRAWING EFFICIENCY
(Material A55, Draw Speed 0.02 in./min, Lubricant Phosphate plus Graphite)

FIGURE 7



SUMMARY PLOT OF THE WIRE DRAWING EFFICIENCIES FOR C11OM ALLOY
(Draw Speed 0.02 in./min)

"optimum" die angle α^*. It is also known that α^* increases with reduction and, at any reduction, is smaller the more effective the lubricant or the lower the frictional losses.

★ ★ ★

Of all the data, those for A55 lubricated with copper plate and zinc stearate (Figure 5) give the best illustration of such relationships. Although the efficiency range at any reduction is narrow, the value of α^* is lowest at the smallest reduction of 10 percent

(*Please turn to page* 1052)

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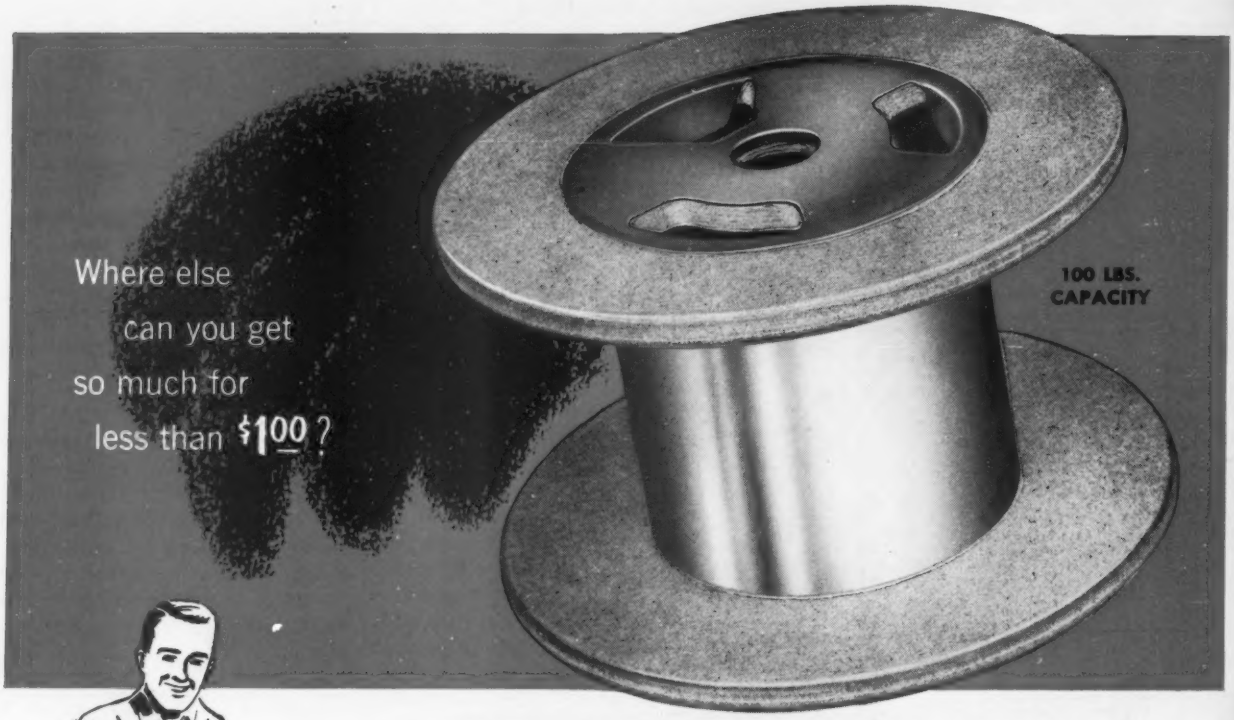

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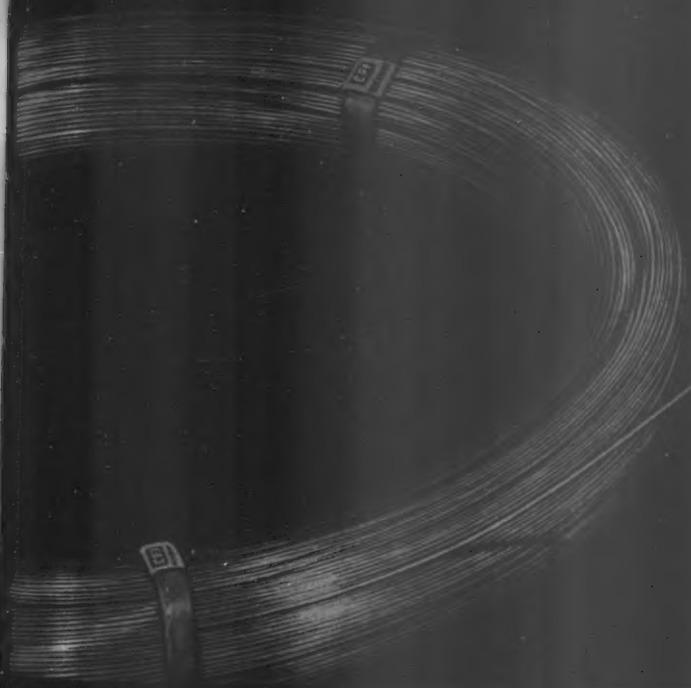
BLACK SATIN

a new, smooth oil tempered wire finish



"Black Satin"... that's the best way of describing the new, fine powdery oxide finish on CF&I-Wickwire Oil Tempered Wire.

It's a finish that makes our wire easier for you to work with... reduces your production costs... and is available in long 600 lb. continuous *unwelded* lengths.

BLACK SATIN

an improved Oil Tempered Wire finish available from CF&I-Wickwire

This powdery finish acts as a lubricant during your coiling and crimping operations. There are no large surface scales to "flake-off". Thus, constant readjustment of your original setup is reduced during production runs. The quality and quantity of your output will remain high without expensive downtime.

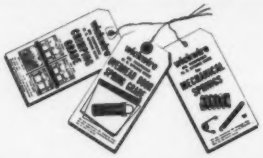
Uniformity Reduces Production Costs—Because our Black Satin finish is extremely uniform from one end of a coil to the other, from coil-to-coil, *and* from lot-to-lot, setup time is minimized. Your output per shift will increase as your equipment will not have to be altered to cope with the varying physical properties of the finish occasionally encountered in coils of Oil Tempered Wire. Scrap losses are reduced because production machinery can run continuously —"stop and go" operations are almost nil when new coils are started.

Extra Large Coils Increase Output—CF&I can further help reduce production costs through our processing and packaging facilities which make it possible to provide extra long coils that lessen the number of setups and resulting scrap loss. If your product is one which (because of production volume or physical size) requires the use of large quantities of Oil Tempered Wire, use our large coils which are available from 16″ to 72″ in diameter. A full range of sizes, grades and finishes of Oil Tempered Wire is available in 600 lb. continuous *unwelded* lengths. Straightened and cut lengths from 6″ to 24 feet (or longer) can also be supplied.

If you are not set up to handle long-length coils, smaller weight packages are available.

Color Tag Identification Assures Quality—Every coil of CF&I-Wickwire Oil Tempered Wire is color-tagged with a complete record of its processing, testing and intended use.

Once you have selected the grade of Oil Tempered Wire that's best for your purpose, you can be sure of receiving the same quality on subsequent orders.



These tags, 3 of which are illustrated, show

Heat Number_____ Size_____

Tensile Strength_____

Date_____ Coil Number_____

Test Sheet Number_____

This identification system helps simplify your job of inventory control, in-plant storage, handling, and reordering.

When You Need Steel Wire Make CF&I Your Source of Supply. Oil Tempered Wire is but one of the many types of specialty wire produced by CF&I. To meet your needs and cut your costs, they can be supplied in a variety of packages: on returnable "Spiders" holding a single continuous length of wire weighing from 2000 to 4000 lbs.; on non-returnable "Spiders" with 500-700 lbs. capacity; in fibre-drums holding up to 600 lbs. of wire; in steel-strapped or wire tied coils (200 to 2000 lbs.) and in bare or paper-wrapped coils, or in 500 to 800 lb. capacity reels.

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5934

Electrical Resistance Welding

by D. S. Faulkner, Esq.
Rylands Brothers Ltd.
Warrington, England

The author is the leader of the Machinery Development Section at Rylands. He has been with the company for 41 years, starting as an apprentice engineer, becoming Mechanics' Shop Foreman and, later, Assistant Plant Engineer.

His paper is concerned with the need for the development of better welding practices in the wire industry. It was presented before a recent session of the Staff School of Frederick Smith & Co. Wire Manufacturers Ltd., Halifax, England, through whose courtesy it is published here.

Those who are engaged in the manufacture of steel wire and wire products in their many forms will quite well understand the importance of electrical resistance welding, particularly when they must have an endless length of wire to assist the many processes in their production.

* * *

Many will also agree that the welding operation has been considered quite an incidental and not a vital operation, with the result that its development has been neglected and little progress has been made since it was first introduced.

* * *

This method of welding is widely used in numerous jobs in many industries outside the Wire Trade, yet little has been written about its particular use in the wire factory. If we consider what has been accomplished overseas, there again—quite contrary to what some people would have us believe—progress has been slow insomuch that in no place do we find a welding machine which will quite automatically take care of all the operations necessary to make uniform welds.

* * *

It would be wrong to disregard the many improvements which have been made with the electrical system of welding machines because they have not been made use of in our industry and because we find that machines which were introduced many years ago are still being used.

* * *

It is not within the Writer's province to deal with the theoretical study of welding as it concerns the physics and metallurgy of the actual weld itself, but rather to try to assist in the design of a machine particularly suitable for the wire trade and the many operations involved, with emphasis on the mechanical design; also to find out just how necessary it is to use modern developments of the electrical system.

* * *

Research, regarding the actual weld itself, is always proceeding on resistance welding for the many jobs outside the wire trade and in that respect there will be no problem in welding steel wire which will not be covered by that research. The development Engineer should always be looking out for new methods and ideas which can be applied to wire.

* * *

We should fully appreciate the importance of welding in the wire industry at the present time, also—what is more important—how valuable a contribution it can make to the automatic factory. It will then be agreed that there is ample opportunity for imaginative thought towards the design of better welding machines, and if what is written in this article does no more than stimulate thought on the matter, it will have served its purpose.

* * *

What a laborious task it would be to have to thread up a multihole wiredrawing machine at the finish of every coil, yet with good welds and good dies, many tons can be drawn without stripping the machine. Welding up wires to keep a continuous run through long furnaces and welding up ends in winding operations etc. also emphasize its importance.

* * *

With regard to the future, let us imagine briefly an in-line operation linking a chain of processes all of which are familiar to those in the trade. All the operations except welding can be done quite automatically.

* * *

The chain of processes can start in the stockyard of any wire firm, where we can expect to find rail trucks of hot-rolled rods all lined up to certain marked positions, so that a crane with the help of an electric eye will quite automatically collect a batch of rods, lift them and transport them to the cleaning house. If we take a look into the cleaning house we shall see the same rods being halted, lowered, lifted and moved from acid to lime, washing and drying cisterns—all done with the help of contactors, timers etc., but without the help of manual labour. Regardless as to whether the advent of descaling does away with acid cleaning on some jobs, the cleaning house need not be a place where men get a living any more. We could once more pick up the batch of rods leaving the cleaning house, traveling towards the wiredrawing machine, where we might expect to find each machine with its own feeding conveyor system on which are placed the batches of rods.

* * *

At this stage, the batches of rods are in the position for welding to give us an endless length.

* * *

What has been outlined will show that at present the only physical labour required will be to do the welding operation. It is within the realms of possibility that we shall be able to say that

wire is brought in at the stockyard and leaves the warehouse wrapped and tested and despatched without physical labour.

★ ★ ★

Enough has been said to show that the welding operation is not incidental but is vital in the chain of operations, if it is going to serve its best function of joining up batches of rods quite automatically so that when the weld is made it can be considered in strength and form quite equal to any part of the wire's entire length.

★ ★ ★

It is quite obvious we do not know how to weld without the man, and in the majority of cases the man is doing every operation.

★ ★ ★

The continuous processes which depend upon the supply of an endless length of wire can be upset at some considerable cost if welds break, also many customers' complaints can be traced to the same source. Yet this operation is at present frequently left to unskilled labour, more often than not supplied with crude tools and an out-of-date welding machine.

★ ★ ★

It is well known that welding up is used to provide an endless length of wire for many processes other than wire drawing, such as the continuous feed to a chain making machine etc. etc., yet if the weld which we make for wire drawing purposes will not break as it goes through the die and as it is bent round the block, it does provide us with an excellent test of its strength in tension and torsion.

The Welding Operation

It is not generally known that in the wire factory there are two quite fundamentally different ways of making a weld, both of which are used. Both are known as electrical resistance welding; the one commonly used is resistance butt welding—the other, not so well known, is resistance flash welding. Flash welding has been introduced in recent years on the larger sizes of ⅜" to 1¼", and at the moment it does appear that size determines the choice of which method to use. Nevertheless, when the two methods are clearly understood, there is no doubt at all that flash welding is the best way to make a weld. It is not surprising that quite a number of claims are made for this method of welding, one being that the weld made gives higher weld strength in tension, shock and torsion.

★ ★ ★

There is a further reason which is becoming more important at the present day, when manufacturers of high carbon patent steel wires are welding rods prior to patenting, so that the welds, thus properly heat treated, may be left in the finished wire to provide long length coils. Although the Writer cannot discuss the metallurgical reasons, he is convinced, after viewing many microsections of patented welds, that those made under conditions of high heat and high speed, such as prevail in flash welding, suffer far less from grain coarsening than welds made by more usual means. Welds free from grain growth possess mechanical properties very similar to those of the parent metal. If this can be proved, then obviously it is the best recommendation for its use.

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However, quite a number of operations are necessary to produce sound, uniform welds, all of which must be carried out with reliable efficiency if the best results are to be obtained, regardless of which method is used.

Flash Welding

Basically, Flash Welding is placing two wires in end to end contact in an electric current.

★ ★ ★

The first operation is to pre-heat the two ends which can be done manually without any skill whatever. To do this, the ends are brought together, held for a short time, then broken apart, and this operation is repeated until a red heat has been produced. There will be a tendency for the wires to stick or prematurely solder together—hence the need to break them apart. The number of times this make and break action is done will, of course, depend upon the current used and the size of wire being welded. When the two ends are at red heat, the next operations should be done quite automatically, because, as will be realized, their very nature requires repetitive skill. That is very difficult and is a good reason why we automate operations.

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The second operation is flashing, which is done by allowing the wires to move progressively, not intermittently, in contact at a predetermined speed for the purpose of bringing the wires up to a welding heat. Sparks will fly with the flashing until the right conditions are produced for the third operation. The flashing operation is a variable time and an accelerated time. An analogy is seen in two runners doing 100 yards in different times but each accelerating towards the winning post.

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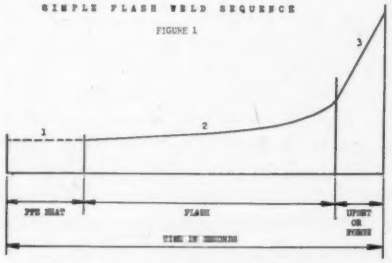
The third and final operation—forging—completes the weld. To forge, the wires are brought together at a speed many times greater than the flashing speed, coupled with the use of a very high pressure. It always reminds one of the crude method of the blacksmith who used to take out of the fire the bar ends sparkling hot for welding, and the striker would hit the job as hard and as quickly as possible. This rapid forging action also squeezes out the slag or oxides which could get trapped within the weld (Fig. 1).

SIMPLE FLASH WELD SEQUENCE

FIGURE 1



(a) The preheat is shown as a broken line indicating the make and break action. If the voltage is reduced then contact could be held.

(b) 1 and 2 is a variable time according to size of wire and voltage; 3 is constant.

(c) At some point on line 3 the power is cut off automatically.

The double action described, coupled with a high potential operating in the minimum time is one of the important differences between the two methods. The rate

of flashing and the speed of the platen or vice is important if the correct conditions are to be established, because if the time is short not enough heat is generated and, in contrast, if it is too long overheating will result, producing bad conditions for forging.

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Tests can be made to select the correct current tapping by flashing the ends to a stop-watch check and removing the ends for examination. Once the speed has been proved correct, the conditions can be repeated.

★ ★ ★

Some sources claim that this flashing method provides a surrounding gas which tends to shield the weld zone from the atmosphere. The conditions of the flashing action do make that claim a possibility yet not much importance should be placed on it. One thing it should do is to create the molten plastic condition for the forge.

★ ★ ★

Experiments have been made in the Metallurgical Laboratory of the Writer's firm to make welds under protective atmospheres such as nitrogen, carbon dioxide etc., with the object of producing better welds; also they have tried to prevent the flash burr by surrounding the wires with refractory moulds. Success was achieved to the point of producing welds which were drawn without de-burring, but the process has not been developed beyond the laboratory stage. There was a lot to be desired in the welding machines available for making such tests, all of which goes to prove that there is much room for the development of a suitable machine.

Claims for Flash Welding

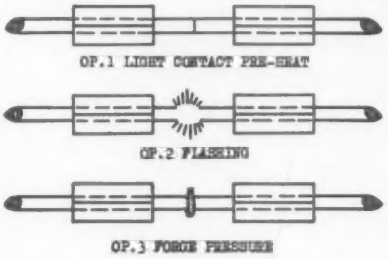
1. **Higher weld strength**
2. **Not so important to prepare the ends for welding**
3. **Lower instantaneous power demand**
4. **Less power consumption**
5. **Welds can be made in less time**
6. **Smaller flash burr or upset**
7. **Better heat concentration**
8. **Variety of metals can be welded**

★ ★ ★

Of the claims given Nos. 1, 2 and 6 can be of some advantage in the welding of wires, particularly when we consider the preparation of the ends and the removal of the burr or upset swelling is done by hand; and of course, as mentioned earlier, No. 1 is the best claim.

★ ★ ★

The importance of the easily removed burr resulting from flash, set against the very pronounced swelling over a considerable length —which we get with upset welding —must not be lost sight of, because in certain in-line operations it raises the possibility of dressing the weld with a shearing die etc. (Fig. 2).



FLASH WELD SEQUENCE

Fig. 2

The number of welds made on machines used in wire production is comparatively low, therefore it is not so important to take advantage of the power saving indicated at (3) and (4).

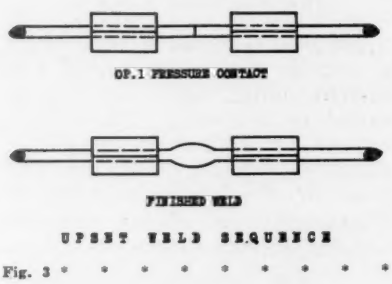
Upset Welding

It is not necessary to say much about this well known and commonly used method in which two wires are placed in an electric circuit and a regulated, uniform pressure applied with no flashing. The heat is generated by the electrical resistances of the two wires being welded, and when the upset has been produced, the power is automatically switched off (Fig. 3).

Advantages Claimed for It

1. **The spatter which we get with flashing is not present because it is a slower gradual build-up of heat.**
2. **There is hardly any extrusion of metal at the zone of weld.**
3. **The upset is more of a uniform swelling.**

★ ★ ★



UPSET WELD SEQUENCE

Fig. 3

The Welding Machine

The purpose of dealing with the welding machine is to try to find out just how much of the present machine we should retain in any future design, and to what extent we can profitably make use of those modern developments which are mainly concerned with the electrical system.

★ ★ ★

The hand-operated machine (the one most widely used) is a very simple machine, both electrically and mechanically, comprised mainly of a transformer, a suitable switch and vice grips or platens to hold the two wires, and through which to pass the current (Fig. 4).

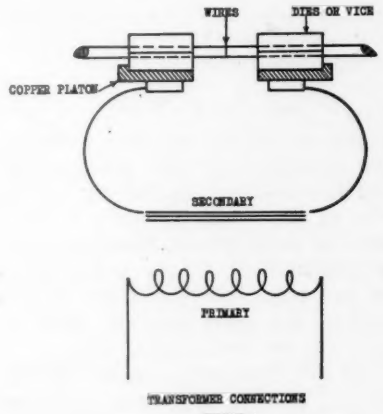


FIGURE 4

The transformer has primary windings connected to the main supply and a secondary winding connected to the vice or platens. One of the platens is fixed and insulated from the main frame, the other can move parallel to it and is to earth. The moving platen can be actuated by triggered-off spring pressure, air cylinder or hydraulics.

The Electrical System

The heat required is obtained by a suitable transformer and the current output or heat can be varied in two ways. The output voltage can be varied by taking suitable tappings from the primary of the transformer, or if finer settings are needed, from an auto-transformer. The electronic method makes use of Ignitron Contactors, known as Phase Shift Control, which, of course, is the latest method.

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Taking tappings from the transformers is a cheap method most commonly used, with satisfactory results, and there is no reason to believe that the weld would be much improved if finer heat controls were introduced. The number of tappings taken from the transformer have, through years of experience, proved adequate to cover all the range of sizes welded, and never is it necessary to change the heat required for every gauge size. Rather do we find that welding operatives often neglect to make the stipulated changes, using a much higher current tapping and less upset pressure in a shorter time cycle. Of course, this practice is quite wrong and is a good reason why we should have more control of the operations.

★ ★ ★

We can, of course, make use of the transformer for pre-heating and normalizing. According to the size of the material being welded and its composition, whether mild or carbon steel, it may be desirable to put heat into the work pieces before the final welding heat is applied, or conversely, after the weld has been made, to normalize a length extending some distance either side of the weld. To do this, tappings of a lower value can be taken from the transformer which can be switched in by hand or sequenced along with all other operations. Normalizing becomes increasingly important as the carbon content of the steel welded increases.

The Switch or Contactor

The switch or contactor is used as a means of closing and opening the power line on the primary side of the transformer. Magnetic contactors are most commonly used for this purpose in conjunction with limit and micro switches which can be hand or foot operated. This operation can also be done by the use of electronic switching, which makes use of two Ignitron contactors to replace magnetic means.

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The advantage of the electronic switch is that when the current is switched on the flow of the welding current always starts at a point in the cycle where the instantaneous value of the current is zero. If the welding current flow is started at random at a point corresponding to the angle of lag of the transformer, large transient currents occur, which we are told could result in burning at the gripper dies.

★ ★ ★

This, of course, could be serious, particularly if the wires being welded are of the speciality groups such as rope wire etc., where breaks could be induced outside the weld region. Electronically operated switchgear must have a special value on production welding, with heavy repeated duty cycles, but we do know the magnetic contactor is well able to stand up to the duties imposed upon it, and its deterioration has not been proved to affect the quality of welds made.

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Magnetic contactors—good, well designed grips — and clean wires combine to produce satisfactory conditions because they do affect contact resistance.

Timing Controls

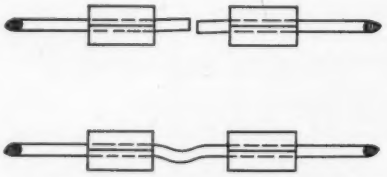
The simple welding machine does not make use of timing controls, but if the operations are done automatically, then it is necessary to sequence time both the mechanical and electrical functions. A non-synchronous timer switches the current on at random with respect to the line current wave form, which results in a variable time as well as a variable input to the machine for as low as ½ cycle in duration; so if we put this against the time it takes to weld even the smallest wires, and also bear in mind it takes .5 of a second to pass 20 cycles, such close time control is not essential.

★ ★ ★

There are also pneumatic timers which, after air has been transferred from one chamber to another through a regulated orifice, are used to actuate contactors; but the simple and quite satisfactory method is the magnetic contactor, which can be co-ordinated with other operations and can take its time period from the positioning of micro switches on cams, etc.

Flash and Upset Dies or Grips

The dies which hold the wires while they are being welded are fixed to the platens which carry the currents and can be water cooled. The conductivity of the material used to make the gripping dies is not so important as its compressive strength or its resistance to oxidation. To increase the length of life of the dies, which are usually alloyed copper, they can be hard faced with Stellite or inserted with a sintering of 95% Tungsten and 5% Copper. This will resist electrical erosion, and many trials carried out prove that any arcing which may occur at the grips is not accompanied by a migration of copper passing to the work, which can be the cause of so much trouble during post-weld fabrication. If the gripper dies are machined in Vee fashion to admit the wires, they must be in perfect alignment so that the two wire ends are not in any way offset (Fig. 5).



MIS - ALIGNMENT
FIGURE 5

Having got some idea of the electrical system, we can now build into the welding machine a cycle of operations which will be

(*Please turn to page* 1049)

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Light Metal Wire Nails

by Ing. Otto Fritz Rabenhorst

Germany

This article appeared in the March 25, 1956, issue of Draht-Welt and is published through their courtesy. It was translated from German into English by Dr. Jerome W. Howe of Worcester, Mass. In it the author discusses various aluminum alloys suitable for nail manufacture and the effect of heat treatment and cold working on physical properties. He also covers treatments that will increase surface resistance to corrosion.

Various advantages over the normally used steel St.00, and even over some higher quality steels, give the light metal alloys great possibilities of application. Apart from their lighter weight, a factor in bulk transport, their durability in sea-water is a superiority to be taken into account. The recognized resistance to corrosion of aluminum suggests its use for such products as roofing nails, shipping box nails, etc.

★ ★ ★

Aluminum materials especially are becoming increasingly preferred in industry, trades, households and agriculture, as much perhaps because of their resistance to chemical agents as for their other physical and technological advantages. It should not be overlooked that this resistance is created by the metal's reaction to the atmosphere, that coats it with an oxide skin. If this is destroyed by mechanical agencies, by the effect strong acids, leaches or electrolytically reactive salts, then the metal is no longer so resistant. This means that the composition of the metal, the soundness of the joints, the cold-worked state of the wire and its surface condition all are important factors.

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The possibility now exists, by means of several different processes, of strengthening the naturally formed oxide coating, thus diminishing the likelihood of damage. For this, so-called inhibitors are used, as, for example, waterglass or resins applied by electrolytic means as a thin film. For just strengthening or thickening the oxide film, hydrogen peroxide and permanganate, for example, are effective.

Several Chemical Coating Processes Available

Chemical processes for the protection of the surface preferably are used because they are so readily carried out. In part, they are also employed in cases where a subsequent finish is to be applied. Some of these are described in the following paragraphs.

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1. MBV process (Modified Bauer-Vogel process). 10 minutes boiling in an aqueous solution of 5% soda and 1.5% sodium chromate gives to the material a bright to a slate gray coat. Its resistance will be increased through hot water flushing or a water-glass solution.

★ ★ ★

2. EW process (Erftwerk process). To the solution described above a small quantity of alkali-fluoride or sodium silicate is added. The result is a still thicker colorless coat, that is not however suitable as foundation for a lacquer.

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3. Alodine process American Chemical Paint Co.). A mixture of phosphoric acid, chromic acid and hydrofluoric acid at 40° to 60°C. Immersion 1 to 4 minutes. Result is a dull light-green coat.

★ ★ ★

4. Bonder process (Bonder 170). Zinc phosphate coating and chromating. The latter on the basis of the chromic acid or chromate with addition of acids to set free the chromic acids in the chromates. (Bonder 700) gray-green iridescent on account of use also of phosphoric acid, or (Bonder 710) golden-yellow layer of several microns thickness, that is quite non-porous and permanent.

These processes differ in the thickness of coating produced. While chromating gives 1 to 2 microns, the phosphate coating is from 2 to 3 microns thick. The coating may be applied by spraying or dipping. The bath temperature in phosphating is between 50° and 60° C, and for chromating between 30° and 50°C. Time of immersion takes about twice as long as time of spraying, from 2 to 10 minutes, according to the concentration of the bath. Both of the Bonder processes give a very good foundation for all kinds of finishes, and, in addition, facilitates cold working.

★ ★ ★

5. Böhmit coating. Treatment of the clean metal with boiling water or steam.

★ ★ ★

6. The Anodic process gives a hard, protective coat up to 15 microns thick, that is correspondingly resistant. Good for decorative staining. Most in use is the Elexol or direct-current sulphuric acid process, or, in the U.S., the chromic acid process. Latterly anodic hardening by use of lower temperature and stronger current density has been tested for use in wear-resistant parts. The cost of this process however is about ten times that of bonderizing.

★ ★ ★

7. Pure aluminum has the highest resistance over all alloys to chemical effects. It is consequently rolled on as plating to less resistant alloys. This is spoken of as rolled plating. A further advantage is its adaptability to color treatment by electrolytic means for securing decorative effects.

★ ★ ★

8. In the U.S. phosphoric acid and zinc tetraoxide chromate are also used as priming, if one of the above mentioned processes is not chosen.

Protective lacquers, such as nitrocellulose, chlorinated rubber or oil paint, may be used. Baked enamel is less to be recommended because of the unfavorable temperature effects.

Buckling of Wire Nails

As contrasted to rivets, that in most cases are liable to compression in use, buckling only occurs from the striking of a nail in cases where the diameter of the nail is disproportionate to its length. Ordinarily, the stress is that resulting from buckling. Choice of material must therefore be made with this in mind. That is, the strength must always exceed the buckling stress that may occur. Elasticity is also an essential factor. This is the most advantageous where the nail, during the striking action by which it is bent, springs back again. The weight of the hammer and with it the impact force is selected accordingly.

★ ★ ★

The point up to which the bending is not permanent, but springs back to its original condition, is called the proportional limit. If this is exceeded and the nail takes a permanent bend, it has buckled. The resistance to further buckling is much reduced over that of an unbuckled nail. Then the impact force can no longer be kept less than the breaking strength and the nail has become useless. Just a slight deflection from a straight line hardly perceptible to the eye lowers the resistance of the nail significantly, because this slight deflection becomes a moment arm for the action of the striking force. It is obvious that the effect of the force should be in the axial direction. Consequently it is advantageous to use small heads that will, through their half-round form, assure a centrally acting transfer of force.

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For buckling formulae, one can refer to the four Euler buckling cases. In the majority of instances, for too great striking energy, the Case II for round-end columns applies. From this it follows that soft materials, like very hard, must be rejected for nail manufacture. It would therefore be idle to carry out researches on those light metals whose properties are fundamentally inferior to those of St.00. For even if no guarantee exists as to commercial quality, one can nevertheless count upon an acceptable elongation value in the highest stress bracket.

Hard Alloys Suitable for Nail Manufacture

The most suitable materials obviously are to be sought in the hard alloys and those that can be hardened.

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The material as supplied today by the aluminum mill without exception is extruded, and a quarter to a half is ordered hard, as this condition is favorable for further cold working. The mills also supply wire drawn to finished size. For drawing they have kept well to the use of textile makers' lubricants, but have also used rape oil and other lubricants of both animal and vegetable origin. H. C. Alcard & Co. brought out several years ago the special lubricants Aludraw 2a and Aludraw 6. These differ in viscosity to suit the different kinds of machines on which they are to be used. Both must be mixed to produce the desired viscosity, for which the manufacturer supplies the instructions. In order to obtain greater strength from hard alloys, more drafts or heavier drafts should be used. Respecting this, however, it must be observed that in the processing there will be a further hardening in the head portion as a result of upsetting. Then splitting can occur, which will ruin the nail head. For such cases of greater hardness or larger heads, the use of a double striker is recommended.

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The advantage of these naturally hard alloys is that after cold working they also retain their beautifully bright natural color, which is not the case with alloys that have to be hardened. By annealing the material can be made soft again. This soft annealing takes place at temperatures between 300° and 400°C, but the process must be suited to the particular characteristics of the material, for which instructions from the aluminum mill should be secured.

Annealing Should Be At High Temperatures

It would be wrong to believe that by annealing at low temperatures an excessively high degree of strength can be somewhat diminished in order to avoid the possible occurrence of splitting. At low temperatures a course grain results that is conducive to brittleness. A fine grain structure results from higher temperature heat treatment. In annealing, the range of sensitiveness, the so-called recrystallization threshold, will be quickly passed through at 230° to 300°C. The grain boundaries are dependent upon the annealing temperatures and the degree of cold working. Greater cold working gives finer grain with the recrystallization, that will be still further improved by annealing at higher temperatures. It follows that in drawing the reduction can not only be high, but actually should be. Practice prescribes the use of suitable annealing ovens, such as air-circulating or salt bath.

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The alloys here discussed get their strength properties through the addition of manganese, magnesium, and sometimes silicon. Magnesium alloys are especially durable in sea-water. For nail manufacture the alloys AlMg2 to 5 are exclusively recommended. In the hard condition their strength is high, averaging between 40,000 and 50,000 psi. However the elongation is small and lies between 3 and 8%. Only in the medium hard state, which is suitable only for short and medium length nails, does the elongation climb to 20%, with decreasing strength and hardness.

Alloys That Can Be Hardened

The hardenable alloys are colored gray by the so-called solution treatment. This coating however is a protective oxidation that is often acceptable to users. If the

(*Please turn to page* 1046)

Costing—A Tool of Wire Mill Management

by E. Copley, Esq.
Frederick Smith & Co. Wire Manufacturers Ltd.
Halifax, England

In order that management may function efficiently it must be provided with information which will enable all phases of the business to be closely controlled. This is essential in modern business as rule of thumb methods are now no longer adequate in today's complex economic system. This necessary information can be supplied by costing, which by the correct analysis and allocation of all the expenses of the business can reveal where inefficiencies and waste exist and thus assist management in deciding just where their energies could most profitably be directed. It is only during the last ten years or so that costing has been largely recognized by management to fulfill a need for a means to the closer control of business, but even now a great number of firms and whole industries are without adequate costing systems. However, it is now more essential than ever to know every detail of cost and be prepared to reduce prices in the face of competition in order to maintain trade, and to this end costs of production must be reduced to a minimum.

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The Wire Industry itself is alive to the need for costing—in 1944 the British Steel Wire Industries Association published a booklet entitled "Uniform Costing for the Wire Industry". This booklet dealt in detail with the methods by which costs, required for Association purposes, should be arrived at and thus made certain that all cost submitted for price review or other purposes would be compiled on the same basis. Firms not having a costing system at that time were able, by following the booklet carefully, to install at their factory a simple system of costing which they knew would be generally in line with others in the trade.

This paper was prepared for delivery at the Staff School of Frederick Smith & Co., but due to the death of Mr. Copley it was not presented. The paper, nevertheless, received the Third Award in the Administration of the Staff School Open Awards. The paper was sent to Wire and Wire Products for publication and is published through the Company's courtesy.

The advantages of costing are almost unlimited and are all in terms of £.s.d. The purpose of this Paper is to discuss the main features of costing, bearing in mind their application to the Wire Industry.

Cost

Total cost consists of Prime Cost and Overhead, and to provide the necessary data for accurate costing these expenses must be thoroughly analyzed and classified. Prime Cost is further broken down into Direct Labour, Direct Material and Direct Expenses, and it is with these three elements of cost we are first concerned.

Direct Labour

The weekly pay-roll should be carefully analyzed departmentally to provide the Direct Wages of the Process Workers and the Indirect Wages of the Service Departments. In the Wire Industry, unlike many other industries, no elaborate methods of time booking are necessary for the purpose of analysis, simply because the total wages of all workers engaged in a particular department represent the total Direct Labour of the department for the period. Overtime which is worked in the normal routine should be charged to that department as Direct Labour, but intermittent overtime is an indirect charge and should be included with overhead.

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Normally there is little movement of men between departments but to cover all possible movements, which if not noticed prevent accurate analysis, a simple method of notification of such Job Transfers should be instituted. In this way the foreman or departmental manager notifies the Wages Office of any changes; although in many instances such transfers involve a rate change for the man concerned, this is not always the case but nevertheless notification is necessary as a transfer overlooked interferes with the accuracy of the Wages Analysis, the correctness of which is vital. It often happens that small details of labour utilization are not recorded and if a number of weeks are allowed to lapse between payment of wages and the analysis being made the foreman or supervisor will undoubtedly have forgotten the circumstances. A weekly routine should be established for this operation ensuring that queries which arise can be dealt with immediately and with greater satisfaction.

Direct Material

This is all material which forms part of the finished product. In many industries the finished product may consist of hundreds of parts which all have to be accounted for from Raw Material Stores to Finished Stock Stores. A great deal of organization is necessary to purchase, store and control the varied materials and components required for the manufacture. This industry finds itself in a comparatively simple position in this respect as there are only the Steel Rod and coatings of Tin and Zinc which can be classified as Direct Material.

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The Stores system should be sound and capable of receiving, storing and delivering large quantities of materials without confusion. All materials should be

recorded on receipt and an appropriate entry made in a Perpetual Stores Inventory which at any time discloses the actual stocks on hand. Similarly, when goods are requisitioned the fact should be recorded in the Inventory before the requisition is passed to the cost department for pricing.

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Requisitions on the Stores for Direct Materials normally emanate from the Production Manager and the Stores arrange delivery of the materials to the appropriate process department.

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Progressing the material through the factory is the responsibility of the production management, but sufficient details should be notified to the cost office to ensure that costing records are maintained in an up-to-date manner. A feature of Process Costing in the Wire Industry is that although one batch of wire passing through a department for a particular order will receive the same treatment as another batch to a different order passing through the same department, the batches do not lose their separate identities. It is, therefore, possible to Job Cost any particular order as it progresses through the works.

Direct Expenses

These are any items of expense, other than Direct Labour and Direct Materials, which can be charged direct to a particular product.

Overhead Analysis

After having dealt with the Prime Cost or Direct Charges we are left with the Overheads of the business. "Last but not least" is very apt where overheads are concerned for although they may be the last to be considered they are not the least of the problems of the Cost Accountant, nor are they least in size of expenses. The Overheads are divisible into Works, Administration, Selling and Distribution Expenses and their correct allocation is one of the most difficult and controversial problems in costing. The expenses have to be analyzed for control purposes and to provide a comparison with previous periods. For this purpose it is convenient to collect the expenses under a system of Account or Standing Order Numbers arranged in groups for particular types of expense, and broken down within each group to give a complete analysis. For instance:

Account Group No. 10 - Plant repairs
Account Group No. 20 - Building repairs
Account Group No. 30 - Power Stores
Account Group No. 40 - Packing Materials
Account Group No. 50 - General Stores etc., etc.

and within these groups:

Account No. 11 - Repairs to wire drawing plant
Account No. 12 - Repairs to patenting plant
Account No. 13 - Repairs to galvanizing plant
Account No. 14 - Repairs to cutting machines etc., etc.
Account No. 21 - Repairs to Power House
Account No. 22 - Repairs to Mechanics Shop
Account No. 23 - Repairs to Warehouse etc., etc.

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This analysis of expense should be taking place continuously and not at the end of six months or a year. A continuous analysis in detail not only saves a great deal of time but ensures a greater accuracy in the analysis.

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The overhead expenses classified under the appropriate account numbers have now to be distributed to the various departments and cost centres, for their eventual recovery on every work order passing through the departments. Before this distribution takes place the expenses should be examined in detail and, where necessary, adjustments made to reflect subsequent changes and known altered conditions. To assist the accurate apportionment of the overhead expenses it is necessary to decide upon the departments to which the distribution shall be made. The term department in this instance does not necessarily mean an area surrounded by four walls, as it is often more convenient to divide the machines in such an area into groups according to their purpose or range, each group thus constituting a separate cost centre. The reason for this is apparent when one considers an area containing six machines of one particular type and two machines of another which may have been placed together for no other reason than that they fit the available space and material flow requirements. Difficulties would be bound to arise in regarding the eight machines as one cost centre, and inaccuracies in the allocation of expenses in this grouping would arise through not taking into account such varying points as differing machines H.P., die usage, and man allocation, etc.

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The only instance when such different items of plant can reasonably be taken as one department for costing purposes would be when all wire passing through the department was bound to pass through both types of machines; one overhead allocation to wire having passed through the department would then be sufficient to recover all expenses. It follows that if only one overhead rate were in use for a department of this nature and wire did not necessarily pass through both types of machines, a charge would be incorrectly made for the expenses of the machines the wire had not utilized. Although needless analysis is wasteful, a breakdown of departments into suitable cost centres has many advantages.

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A cost centre may also be so described when it has no permanent location or no fixed position on the factory floor. An example of this type of cost centre is Internal Transport which, as a Service Department, must bear its share of the overhead expenses before final allocation to Production Cost Centres.

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The cost centres for overhead recovery having been decided upon details concerning each department are required for use in allocating certain expenses. It is most unlikely that the number of units of electricity consumed in a period for lighting purposes will be metered to each department and in-

deed it would be an unnecessary expense to do so as the greater accuracy to be achieved by this would be negligible. Therefore, the wattage of the lighting equipment should be determined for each cost centre and the total expense of lighting allocated proportionately on the basis of the known wattages. This method is reasonably accurate and is very useful for the allocation of other expenses such as water consumption per gallon/hour; gas per cu. ft./hour; electricity power per machine, H.P., etc.

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It is found very convenient to record all this information in card index form. A suitable sized card is prepared for each cost centre showing on it the name, departmental number and location. The information applicable to each cost centre and necessary for the apportionment of the expenses is recorded thereon, and in a suitable space on the card the date on which the information was obtained is stamped. The date is particularly important as in any modern factory changes are constantly being made and these may affect any item on the card. It is always a simple matter after referring to the latest recorded date for the engineering department to determine which cost centres are affected by alterations since the particular date, and to keep them up-to-date it is advisable to have the cards examined at regular intervals.

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On the basis so far outlined it is now possible to proceed with the allocation of the expenses to cost centres. The treatment of each item of expense varies according to the available information and the Cost Accountant must give a great deal of thought to this matter in order to produce the most accurate results.

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It has already been mentioned that the cost of electricity consumed in lighting will most likely be allocated on the basis of the known wattage in each department or cost centre and gas consumed, if not specially metered, on the basis of cu. ft. per hour. Where extra time may be worked in some departments and not in others it will be necessary to adjust the basis to allow for additional consumption due to the extra working time. Whenever possible it is obviously an advantage to determine the actual cost of any item of expense to each cost centre; this improves the accuracy of the overhead allocation and increases confidence in the final figures, but it should not raise the expense of costing out of proportion to the benefit obtained.

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A plant inventory is necessary in this respect and should be utilized for providing an accurate breakdown of depreciation or wear and tear expense. It should, of course, be capable of reconciliation with the financial accounts when an analysis of the depreciation departmentally will allow each cost centre to be allocated with its actual chargeable depreciation. A plant inventory's usefulness is not limited to providing an analysis of depreciation and much information is speedily available for the many questions regarding the history and value of any item of plant.

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In addition to the Production Departments the Service Departments—Maintenance, Die Room, Laboratory, etc., have been receiving their share of expenses and finally it comes the turn of these service departments to be allocated to the cost centres which they serve. Here again we are faced with the problem of the most accurate method of allocation, and again it must be one which will produce the most accurate results without itself being prohibitive in cost. Care must be taken to spread the totals of these service departments in the correct order. For instance, before the Die Room expense is allocated to the Wire Drawing Departments it should receive its share of the Maintenance Department expense. Similarly, the Stores expense should be allocated to Maintenance and Die Room before they in turn are allocated to other Departments. On completion of the allocation of the Service Department Expenses the totals of overhead expenses for each of the production departments can be ascertained and this brings us to the next stage which is the method of recovery of these overheads on the materials passing through the departments.

Overhead Recovery

There are many methods of charging overheads to the product in order to find its total cost, and a number of different methods may be used in one factory. The problem is to find a method which will charge each Works Order with the true overheads incurred in its manufacture. To a large extent the Overhead Recovery problem is related to time, and usually any method which has a time factor as its basis will be satisfactory.

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A popular method and one which finds favour in the Wire Industry is that of a percentage on direct wages. This method is advocated in the Uniform Costing System of the Industry and indeed the accuracy of the costs would not be improved in many instances by providing a more elaborate method. Many of the disadvantages of a percentage on Direct Labour are non-existent in this industry; for instance, varying rates are reduced to a minimum because the nature of the work makes it unlikely that women or boys will be employed in similar jobs as men. There are very few occupations in this industry in which it is possible to employ anyone but adult males, and in most cases it is usually found that a uniform rate for the job is paid in each department. Consequently any allocation of overhead on the basis of a percentage on Direct Labour in these circumstances is quite sound. As already mentioned, the simplicity and suitability of the method for the industry have been factors which have led to the popularity of a percentage on Direct Wages but, whilst it is not suggested that more complicated methods should be used, there are occasions when a different method would offer advantages.

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For instance, when a piece rate

is payable for a specified quantity of work this may have no relation whatsoever with a time factor. Therefore, no matter how long the worker takes to complete the job the overhead chargeable would remain the same. To overcome this difficulty it is more convenient to establish a number of machine-hour rates in these departments, and then work passing through the departments will bear its fair share of overhead. By this method the overhead expenses are distributable in proportion to the operating hours of the machines. This is particularly suitable for the Wire Industry as production is largely by machinery, and although considerable preliminary work is necessary to set up reliable rates the greater accuracy in the costs makes the effort worthwhile. A machine-hour rate should be set up for each type of machine; machines are often grouped departmentally according to their kind and as they are already described as one production cost centre for costing purposes one machine-hour rate will be eminently suitable. Similarly in departments where machinery does not predominate and work is performed mainly by hand, labour-hour rates can be calculated to achieve the same purpose.

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When building up a cost it is necessary to take a suitable unit of production as a basis for the cost. This varies considerably according to the type of industry. The factory manufacturing cloth will probably find the most convenient unit is per yard of material, a colliery per ton of coal raised, milling per sack of flour, a brewery per barrel of beer racked and brick making per thousand bricks. In the wire industry it is usual for 1-ton of wire to be used as the cost unit. In calculating the cost of certain processes this may not, however, be entirely satisfactory. This proves to be the case in the Cleaning Yard where all rods and wire are passed through the process on metal hooks. These metal hooks are referred to as pins. Although the weight of rods or wire on each pin varies considerably the process for each pin load is the same in every case. Therefore, to base the cleaning cost on one ton of rods or wire would give false figures, but by adopting a more suitable cost unit in this department (the pin load) a true overhead figure can be allocated.

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A cost sheet is prepared showing the type of wire for which the cost is required and each process through which the wire has passed is listed. The costing records will provide the cost of each process and after entering each one it remains only for the cost of Selling and Administration to be added. As Selling Prices in the Wire Industry are controlled the price at which the wire will be sold is already known and for comparative purposes this is usually shown on the cost sheet on completion.

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A Costing System should not be confined to providing only historical product costs, as much useful information can be gained by extracting figures from the costing records. Many efficient businesses are now using Budgetary Control and Standard Costs, which have several advantages over historical costs. Budgetary Control and Standard Costs are often considered to be inseparable and entirely dependent on one another; however, it is possible to operate Standard Costs without a formal system of Budgetary Control, but before Standard Costing could be carried out it would be necessary to create similar conditions to those of Budgetary Control, within which the activities of the organization are to be carried on and which are normally included in the budgets of the business. Budgetary Control, however, can be operated in industries where it would be difficult to apply Standard Costing.

Budgetary Control

Budgetary Control provides for the planning and controlling of the income and expenditure of manufacturing and trading operations so that the most practicable profit is obtained. This is brought about by the detailed preparation of budgets covering every phase of the business. Commencing with the Sales Budget it must forecast the total sales for the period of the budget, expressed in money and quantities, and is prepared under various classifications and after consideration of many relevant details. Following the Sales Budget comes the Production Budget, Plant Utilization Budget and so on to Purchasing Budget and Cash Budget. The Budget period can be any length of time but the natural period is one year. Longer term budgets should be supplemented by short term ones, for instance, those of three to five years by budgets of one year or less. In the case of firms using a main budget of one year preparation of budgets for one month will be helpful. The headings of analysis used in preparing the budgets should be identical with those used in the Accounting system so as to assist the preparation of Budget and Actual Comparison Statements.

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It is essential that statements comparing budgeted expenditure with actual expenditure should be prepared frequently and without delay, since delays in preparation and presentation of these figures prevent them being used to full advantage. Any variances brought to light by the comparison of budget with actual figures should be capable of being explained, and careful examination should be made in order to ascertain the reasons. After careful consideration of the results shown in the Comparison Statements appropriate action should be taken where necessary to correct matters where budget standard has not been achieved.

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Causes of over expenditure should be investigated and in cases where the policy on which the budget is based is at fault and has in fact been superseded a new budget should be compiled and substituted. Control of expenditure is thus much clearer and more precise with Budgetary Control.

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All variations are pin-pointed

and each and every cause can be investigated with a view to preventing the recurrence of those within the control of the management.

Standard Costing

The Institute of Cost and Works Accountants publication "An Introduction to Budgetary Control, Standard Costing, Material Control and Production Control" defines Standard Costing as: — "The preparation of standard costs and their use to clarify the financial results of a business, particularly by the measurement of variations of actual costs from standard costs and the analysis of the causes of the variations for the purpose of maintaining maximum efficiency by executive action." Standard Costing is generally considered to be the most advanced technique for the efficient ascertainment of costs. It does, however, need the operation of pre-determined expense budgets which, when compiled by competent authority and used as an instrument of control, become in effect Budgetary Control.

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Standard Costing is generally applied without difficulty in businesses engaged in repetitive work, process or unit operation manufacturing, or some form of continuous operation as distinct from irregular job or order work. That is not to say that Standard Costing cannot be applied to Job or order work but that in such industries the standard cannot be set in the usual manner and each job or order will require individual attention to ascertain its Standard Costs.

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Standard Costs are pre-determined costs in relation to an assumed volume of production, and serve as a measure against which ascertained actual costs may be compared to test efficiency of production. It can easily be seen, therefore, that if the Standard is based on normal working it is excellent for revealing the degree of efficiency obtained in actual production and provides an incentive for improving performance and operating conditions. To direct attention to a comparison of the efficiency at each stage of production, details should be provided of The Standard Cost, The Actual Cost and the ratio between these costs. Inefficiencies brought to light by investigations of the reasons for variances can be corrected during manufacture. This in itself is an enormous saving on other methods of costing which only provide details of costs when the job is finished; it is then too late to rectify the cause on that particular job or batch and possible only to take steps to avoid such occurrences for the future.

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The calculation of standards is a long and difficult task and for this reason it is not usual to vary them without very good reason. Alteration of the standards can be avoided for long periods by the use of cost ratios or efficiency percentages to cover any adjustment. This type of costing does not necessarily displace historical costing except that it reduces the volume of information required in respect of past results. Information is made available in the form of departmental operating statements for management at all levels. The information given on each statement should be only that over which the person receiving the statement has control. Wrong conclusions are liable to be drawn from the figures provided unless full explanation has been given to those receiving the statements as to how to interpret the figures. Education in these matters is very necessary to ensure that correct use is made of the data and it is just as desirable that the Cost Office do not provide too much information otherwise it may not be acted upon at all through lack of time to read and digest it. It is essential that the information is supplied with all possible speed, and as the departmental managers are able to check what is happening under their control they are able to eliminate faults while the work is still in progress. One of the chief advantages of this method is that the efforts of management are always directed in the correct channels, for while production is conforming to standard everything is assumed to be in order and their energies are directed to the examination and rectification of the reasons for variances.

Cost Reduction

Efforts should be made at all times to effect reductions in cost and, in addition to cutting down material wastage and idle time and endeavoring to speed up production, attention should be given to certain aspects of the overheads of the business which may very easily be ignored. Overheads which are correctly apportioned and recovered in the costs may in fact be found to contain out-of-date charges and should therefore be carefully checked.

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An examination of the amount paid in rates to the local authority may reveal that buildings no longer in existence or not now occupied are still being assessed. Rents too should receive similar attention as it can so easily happen that property rented for a specific purpose has long ago been vacated. Land originally purchased for development and which is incurring taxes may be wholly unproductive through a change of plans and may be sold with advantage. Insurance is also a factor which has been known to conceal unnecessary expense and a periodical review of all insurances should be made, and any which have served their purpose should be cancelled and not be automatically renewed. Savings can also be made on apparently small items — stationery supplies often reach gigantic proportions when orders are placed without regard to forms at present in use; in many cases when these matters are studied it is found that forms can be combined and made to serve two or three purposes, in which case many of them can be discontinued. This type of approach often helps in reducing printing costs.

Presentation of Information To Management

The fact that costing is carried out as an aid to management should always be borne in mind—

(*Please turn to page* 1043)

THE ANNUAL CONVENTION OF THE WIRE ASSOCIATION

HADDON HALL HOTEL, ATLANTIC CITY, N. J., MONDAY THROUGH THURSDAY OCTOBER 13-16, 1958

The Wire Association's Headquarters at The Haddon Hall Hotel
will be open each evening from Sunday, October 12th, except Wednesday night.
YOU ARE CORDIALLY INVITED TO CALL AND MEET OTHER WIRE INDUSTRY MEN

THERE WILL BE A REGISTRATION FEE OF $13.00 FOR MEMBERS AND $15.00 FOR NON-MEMBERS, INCLUDING AN ANNUAL LUNCHEON TICKET, FOR ALL THOSE ATTENDING THE TECHNICAL SESSIONS AND MEETINGS. PLEASE HAVE YOUR ASSOCIATION MEMBERSHIP CARD WITH YOU AND SHOW IT WHEN REGISTERING.

ADMISSION WILL BE BY BADGE ONLY—PLEASE WEAR IT.

THE WIRE ASSOCIATION PROGRAM COMMITTEE FOR THE 1958 CONVENTION

GENERAL PROGRAM CHAIRMAN
Raymond S. Worth
Manufacturing Manager, Wire Mills Division
John A. Roebling's Sons Corporation
Trenton, N. J.

GENERAL ACTIVITIES

EXECUTIVE SECRETARY

Richard E. Brown
The Wire Association
Stamford, Conn.

REGISTRATION

R. S. Spengel, Asst. Exec. Secy.
The Wire Association
Stamford, Conn.

ENTERTAINMENT

Eber J. Hubbard, Pres.
Hubbard Spool Div.
American Pulley Co.
Garrett, Ind.

All papers presented at the Convention by members of The Wire Association are eligible for consideration for the Annual Medal Award, and will be voted upon by the Board of Directors at the next Spring meeting of that body.

FERROUS DIVISION

CHAIRMAN

Dartrey Lewis, Chf. Eng., Research & Development
John A. Roebling's Sons Corp.
Trenton, N. J.

COMMITTEE MEMBERS

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Kansas City, Mo.

William Mohr, Works Mgr.
The Colorado Fuel & Iron Corp.
Oakland, Calif.

A. M. Reeder, Met. Eng.
Jones & Laughlin Steel Corp.
Pittsburgh, Penna.

Technical papers are preprinted in the October issue of Wire and Wire Products insofar as possible. Titles to papers accepted will be given to The Wire Association and duly copyrighted at the time of publication.

NON-FERROUS DIVISION

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Bell Telephone Laboratories, Inc.
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Trenton, N. J.

H. S. Spaulding, Tech. Supt.
Kaiser Aluminum & Chemical Corp.
Newark, Ohio

All wire mill men and wire mill suppliers are invited to attend this convention, see how the Association functions and participate in the activities. Simultaneous technical sessions for Ferrous and Non-Ferrous Divisions are held.

REGISTRATION AND TECHNICAL MEETING ROOMS ARE ON THE 13TH FLOOR. Please be prompt in your arrival for the technical sessions. Those with rooms for entertainment are requested NOT TO KEEP THEM OPEN during the technical sessions.

MONDAY, OCTOBER 13th

9:00 A.M.
REGISTRATION

10:00 A.M.
DIRECTORS' MEETING

12:30 P.M.
PROGRAM COMMITTEE LUNCHEON

THE CONVENTION PROGRAM

MONDAY MORNING—

9:00 A.M. Registration Desk opens on the 13th Floor
10:00 A.M. Meeting of the Board of Directors of The Wire Association
12:30 P.M. Directors' Luncheon for Program Participants. Address of Welcome by President Tom M. Girdler, Jr.

MONDAY AFTERNOON—2:00 P.M.

JOINT FERROUS AND NON-FERROUS TECHNICAL SESSION

Address of Welcome by Tom M. Girdler, Jr., President of The Wire Association

SYMPOSIUM ON ALUMINIZING

MODERATOR

C. C. Tappero, Wire Mill Superintendent
Colorado Fuel & Iron Corp., Pueblo, Colo.

PAPER: "Aluminum Coating of Steel Wire"	by H. J. Godfrey, Asst. Chief Eng., Research & Development, John A. Roebling's Sons Corp., Trenton, N. J.
PAPER: "Batch Type Aluminum Coating of Small Steel Parts"	by Robert F. Joy, Eng., Development Research Department, Bethlehem Steel Co., Bethlehem, Pa.
PAPER: "Aluminum Coated Steel Wire Products"	by R. E. Griffiths, Asst. Dir. of Research, American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
PAPER: "Alumoweld Wire"	by Leslie C. Whitney, Dir. of Res. & Devel., Copperweld Steel Co., Glassport, Pa.
PAPER: "Resistance to Corrosion of Aluminum Coated Steel Wire"	by E. T. Englehart and K. J. Brondyke, Alcoa Research Laboratories, New Kensington, Pa.

TUESDAY MORNING—9:30 A.M.

FERROUS TECHNICAL SESSION

MODERATOR

Charles H. Williams, Jr., Supt., Rod & Wire Mills
Pittsburgh Steel Co., Monessen, Pa.

PAPER: "The Manufacture of Welded Wire Mesh and Some of Its Uses"	by Charles A. Kuhl, Metallurgist, Pittsburgh Steel Co., Monessen, Pa.
PAPER: "Mechanical Descaling of Wire Rod in England"	by H. F. Sanderson, Wire Mill Manager, Fredk. A. Power & Sons Ltd., Saltley, Birmingham, England
PAPER: "Lead Patenting of High Carbon Steel Rod and Wire"	by Rudolph H. Hertzog, Metallurgical Eng., Steel Wire Mills Div., John A. Roebling's Sons Corp., Trenton, N. J.
PAPER: "Galvanizing Wire by the Sendzimir Process"	by Richard Bliss, Furnace and Associated Plant Equipment Sales, General Electric Co., Shelbyville, Ind.

THE CONVENTION PROGRAM

TUESDAY AFTERNOON—2:00 P.M.

FERROUS TECHNICAL SESSION
SYMPOSIUM ON SHOT BLAST CLEANING OF ROD

MODERATOR

Walter O. Everling, Director of Research
American Steel & Wire Div.
United States Steel Corp., Cleveland, Ohio

PAPER: "Part I—Problem of Pollution of Rivers by the German Steel Industry"
"Part II—An Installation for Shot Blast Cleaning of Rod"
by Dr. H. Berge, Asst. Tech. Dir. (Part I)
and Dr. Hans Krautmacher (Part II)
Westfalische Union, A. G.
Hamm (Westf.), West Germany

PAPER: "Continuous Patenting, Cleaning and Coating of Rod."
by R. F. Warner, Wire Mill Mgr.
Leschen Wire Rope Div.
H. K. Porter Co., St. Louis, Mo.

PAPER: "Recent Experience with Shot Blast Cleaning of Rod"
by Kenneth J. Sorace, Chief Proj. Eng.
Lamson & Sessions Co.
Cleveland, Ohio.

PAPER: "Continuous Patenting, Cleaning and Coating of Rod."
by Donald K. White, Fore., No. 2 Wire Mill
John A. Roebling's Sons Corp.
Trenton, N. J.

WEDNESDAY MORNING—9:30 A.M.

FERROUS TECHNICAL SESSION

MODERATOR

Stewart S. Gray, Asst. Vice President
Union Wire Rope Corp., Kansas City, Mo.

PAPER: "A Modern Order Entry and Invoicing System"
by T. W. Herman, Manager of Orders
and J. C. Farrell, Asst. Mgr. of Orders
Union Drawn Steel Div.
Republic Steel Corp., Massillon, Ohio

PAPER: "Engineering Report — Experimental Prestressed Concrete Highway" (Discussion and film)
by Carleton W. Garrett, Met. Eng.
Product & Development Div.
Jones & Laughlin Steel Corp.
Pittsburgh, Pa.

PAPER: "Spooling of Fine Wire"
by Raymond O. Hallberg, Genl. Supt.
and Fred A. Locke, Chief Process Eng.
Wilbur B. Driver Co., Newark, N. J.

PAPER: "Pressure Lubrication of Wire Drawing Dies—A Practical Application"
by Arthur V. Hedman, Die Room Foreman
Wickwire Spencer Steel Div.
The Colorado Fuel & Iron Corp.
Palmer, Mass.

NON-FERROUS DIVISION PROGRAM

TUESDAY MORNING—9:30 A.M.

JOINT NON-FERROUS TECHNICAL SESSION
SYMPOSIUM ON ELECTRICAL TESTING

MODERATOR

Alexander A. Kerr, Supt. of Production
Electrical Wire and Cable Div.
John A. Roebling's Sons Corp., Trenton, N. J.

PANEL MEMBERS

Joseph E. Byrnes
Wire & Cable Dept.
General Electric Co.
Bridgeport, Conn.

Gordon Bamber
Phillips Electrical Co., Ltd.
Brockville, Ont., Can.

Harry Slade, Res. Eng.
The Okonite Co.
Passaic, N. J.

John Heuther
Canada Wire & Cable Co. Ltd.
Toronto, Ont., Can.

J. K. Gillett
Entwistle Mfg. Co.
Providence, R. I.

D. H. Bodle
Bell Telephone Laboratories, Inc.
Murray Hill, N. J.

H. Peschel
Peschel Electronics, Inc.
Patterson, N. Y.

James L. Entwistle, Pres.
James L. Entwistle Co.
Cranston, R. I.

THE CONVENTION PROGRAM

TUESDAY AFTERNOON—2:00 P.M. NON-FERROUS PROGRAM CONTINUED

SYMPOSIUM ON HIGH SPEED DUAL TAKE-UPS

MODERATOR

Alexander A. Kerr, Supt. of Production
Electrical Wire and Cable Div.
John A. Roebling's Sons Corp., Trenton, N. J.

PANEL MEMBERS

Philip C. Greene, Pres.
Davis-Standard Div.
Franklin Research Corp.
Mystic, Conn.

O. Minardi, Chf. Eng.
Entwistle Manufacturing Co.
Providence, R. I.

B. J. Algar
General Engineering Co. (Radcliffe) Ltd.
Radcliffe, Lancs., England

Harry J. Bates
Reliance Electric & Engineering Co.
Cleveland, Ohio.

TUESDAY AFTERNOON—2:00 P.M.

INSULATING MATERIALS

MODERATOR

James S. Higgins, Plant Eng., Copper Div.
Walker Brothers, Conshohocken, Pa.

PAPER: "High Density Polyethylene for Insulation" — by B. H. Krevsky, New Products Engineering Dept., Bakelite Company, New York, N. Y.

PAPER: "Wire Insulation of 'Teflon'(R) FEP-Fluorocarbon Resin; Properties and Fabrication" — by Robert S. Lovett, Elec. Applications Technol. and Robert E. Stabler, Product Technologist, E. I. du Pont de Nemours & Co., Wilmington, Del.

PAPER: "Preheating Conductors in Extrusion Insulating Processes by Copper Loss Method: Temperature is a Function of Current" — by J. W. Lechleider, Bell Telephone Laboratories, Inc., Murray Hill, N. J.

PAPER: "The Thermal Embrittlement of Stressed Polyethylene" — by J. H. Heiss and V. L. Lanza, Bell Telephone Laboratories, Inc., Murray Hill, N. J.

WEDNESDAY MORNING—9:30 A.M.

POWER CABLES

MODERATOR

John C. Murray, Jr., Vice Pres.
Crescent Insulated Wire & Cable Co., Trenton, N. J.

PAPER: "The Performance of Vinyl Insulation Rated for 75°C THW Service" — by H. L. Wuerth, Mgr., Wire & Cable Materials, B. F. Goodrich Chemical Co., Cleveland, Ohio

PAPER: "Polyethylene for Overhead Line Wire" — by F. W. Wurtzell, Central Zone Mgr., Bakelite Co., Chicago, Ill.

PAPER: "Polyethylene for Power Cables" — by M. M. Suba, Tech. Rep., Bakelite Co., New York, N. Y.

PAPER: "Fabrication and Properties of 5005 Aluminum Alloy Cable for Overhead Power Cables" — by Harold W. Adams, Prod. Supvr., Electrical Conductor Products, Reynolds Metals Co., Louisville, Ky.

WEDNESDAY MORNING—9:30 A.M.

COMMUNICATION WIRES

MODERATOR

Marshall V. Yokelson, Research Metallurgist
General Cable Corp., Bayonne, N. J.

PAPER: "Plasticized Polyvinyl Chloride for Retractile Cords" — by J. B. DeCoste, J. B. Howard, V. T. Walker and H. M. Zupko, Bell Telephone Laboratories, Inc., Murray Hill, N. J.

(Please turn to page 1004-B)

NAUGAPOL K-50

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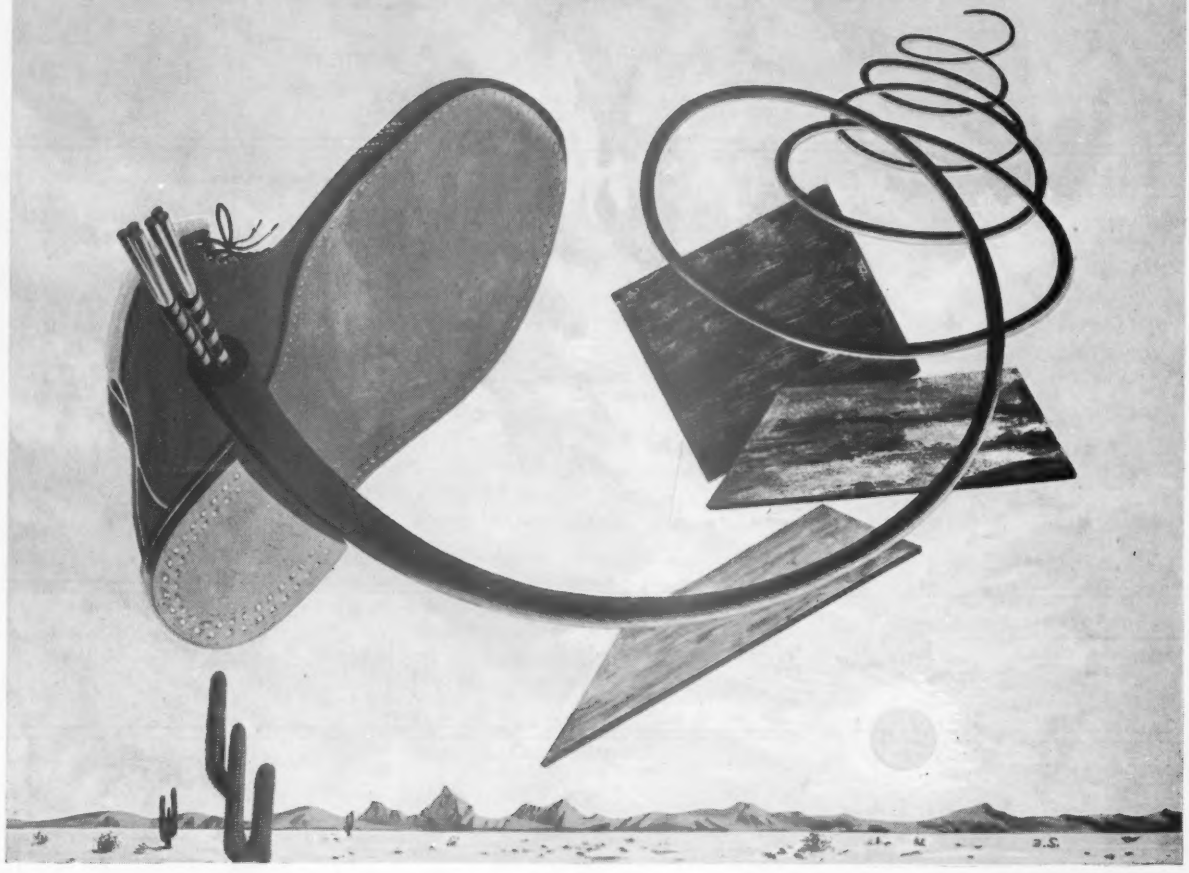

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THE CONVENTION PROGRAM

WEDNESDAY MORNING—9:30 A.M.

COMMUNICATION WIRE SESSION CONTINUED

PAPER: "Inclined Enameling Machines for Coating Fine Gage Wires" — by Charles L. Erickson, Devel. Eng. and Grady Walker, Prodn. Eng. Western Electric Co. Buffalo, N. Y.

PAPER: "Accelerated Aging Tests in Service Performance of Neoprene Jacketed Drop Wire" — by A. P. Jahn and G. N. Bacca Bell Telephone Laboratories, Inc. Murray Hill, N. J.

WEDNESDAY AFTERNOON—1:00 P.M.

LADIES WELCOME

THE ANNUAL WIRE ASSOCIATION LUNCHEON

LADIES WELCOME

PRESENTATION OF AWARDS FOR 1957 PAPERS:

MEDAL AWARD (Ferrous Division): To Dartrey Lewis, Chief Eng., Research & Development, John A. Roebling's Sons Corp., Trenton, N. J., for his paper: "Combined Hot Rolling and Patenting of Rod."

MEDAL AWARD (Non-Ferrous Division): To Clement C. Lawson, Plant Facilities Engineer, Bell Telephone Laboratories, Inc., Murray Hill, N. J., for his paper: "Buried Distribution of Telephone Circuits."

CERTIFICATE OF HONORABLE MENTION (Ferrous Division): To E. Jefferson Crum, R. H. Miller Co., Homer, N. Y., for his paper: "The Coreless Coil—A New Wire Handling System."

CERTIFICATE OF HONORABLE MENTION (Non-Ferrous Division): To A. A. DeFoe, Chief Eng., Electrical Conductor Engineering Dept., Aluminum Laboratories Ltd., Kingston, Ont., Can., for his paper: "Oxide Coatings on Aluminum Wire."

PRESENTATION OF TWENTY-FIVE YEAR CERTIFICATES by Leslie C. Whitney, Chairman, Board of Past Presidents.

THE MORDICA MEMORIAL LECTURE by David Dwight Buchanan, Johnstown, Penna.

WEDNESDAY AFTERNOON—4:00 P.M.

THE ANNUAL MEETING OF THE WIRE ASSOCIATION

This is the business meeting for Association members. Your personal attendance is desired and needed for the transaction of business.

WEDNESDAY EVENING

THE ANNUAL STAG SMOKER-DINNER

6:30 P.M.—Cocktail Bar Opens

7:30 P.M.—Dinner and Show

THURSDAY MORNING

PLANT INSPECTION TRIPS

Busses will leave the hotel at 8:30 A.M. for Roebling, N. J., for the Steel Wire Mills of John A. Roebling's Sons Corp., for the Ferrous Division Tour.

At the same time busses will leave also for Trenton, N. J., to visit Roebling's Electrical Wire and Cable Plants—of interest to the Non-Ferrous Division men.

Luncheon will be served at Roebling, N. J., for both Divisions.

Persons desiring to leave from Trenton after the tours, will be taken to the station and private cars may be used by those who have come to the Convention in them.

PLEASE WEAR YOUR BADGE ON THESE TOURS AND CARRY YOUR BUS TICKETS

Insofar as possible, all papers will be preprinted in the October issue of Wire and Wire Products. Others will be printed in November and December.

The Convention proceedings, the Story of the Convention and the Mordica Memorial Lecture will be published in the January, 1959, issue.

New Developments in Cable Jacketing Compounds

by

D. W. Dahringer and W. T. Higgins

Development Engineers

Bakelite Company

Division of Union Carbide & Carbon Corporation

Bound Brook, New Jersey

A paper presented at the Fifth Annual Wire and Cable Symposium of the Signal Corps at Asbury Park, N. J.

Polyvinyl chloride compounds have been used extensively in the wire and cable field for almost twenty years because of their excellent physical and electrical properties and because of their versatility. By the selection of the proper plasticizer and other ingredients vinyl compounds can be formulated with particular properties to suit a variety of applications. However, there are some applications which tax even the most versatile of the conventional vinyl compounds. Such is the case with the vinyl material which must meet the requirements for Type IIa, non-migratory jacket under MIL-C-17B specification.

★ ★ ★

To overcome the shortcomings of conventional vinyl compounds, a new vinyl chloride material has been developed, Bakelite Brand NFD-3000. This compound is a so-called "internally plasticized" material which possesses adequate flexibility without the use of plasticizers or other modifiers. And this flexibility is available with no sacrifice of the other properties normally affected by adding plasticizers, such as electrical properties, toughness, and abrasion and deformation resistance. NFD-300 exhibits an unusual combination of the superior properties of rigid and plasticized vinyls.

★ ★ ★

The technical advantages of this new material can be demonstrated by considering its suitability for Type IIa, non-migratory cable jackets under MIL-C-17B specification. To meet the requirements for this application, conventional vinyl materials require a delicate balance of modifiers plus very careful compounding and critical control of extrusion. Even when these conditions are satisfactorily observed, the finished cable may still show evidence of changing electrical properties because of slight plasticizer migrations. Until the development of this new internally plasticized material, electronics engineers had to rest content with only an approximate resolution of the requirements of this specification.

★ ★ ★

NFD-3000 offers an ideal solution to the requirements of the specification. This compound is absolutely non-migratory since it contains no plasticizer or other modifiers. And tests have confirmed this. Section 3.14.1 in the MIL-C-17B specification requires a less than 2.0db./100 ft. change in attenuation of a jacketed cable aged seven days at 98± 2 deg. C. A sample of RG-9 B/U coaxial cable* jacketed with NFD-3000 was tested and exhibited only 0.8db./100 ft. change. This was well within the specification limit.

★ ★ ★

The other major requirement for the Type IIa jacketing material is low temperature flexibility as indicated by cold bend performance on the finished cable. The requirement is a 10X Mandrel bend at -40 deg. C. after a twenty-hour conditioning.

★ ★ ★

Table I shows cold bend test results on samples of RG-9B/U cable jacketed with both this new material, NFD-3000, and a typical commercial jacketing material. As can be seen, the new material exhibits a much wider safety margin of the -40 deg. C. requirements than the old type material despite its lack of plasticizer and other modifiers. This margin would still be adequate if the specification were to require a -55 deg. C. cold bend or for special cables to be used in extremely cold areas such as the Dew Line and in the Antarctic.

TABLE I

COLD BEND, 10X MANDREL: TWENTY HOURS CONDITIONING

	Typical Jacketing Material		NFD-3000	
Temperature	Pass	Fail	Pass	Fail
—40 deg. C.	5	0	5	0
—45 deg. C.	5	0	5	0
—50 deg. C.	4	1	5	0
—55 deg. C.	3	2	5	0
—60 deg. C.	0	5	5	0
—65 deg. C.			3	2
—70 deg. C.			1	4

★ ★ ★

The cold bend temperature for the aged constructions under both the old and new specification is shown in Table II. As can be seen, the new material still maintains an excellent margin of safety as opposed to a doubtful margin for the old material with respect to the new requirement of seven

* Made and tested by Federal Telephone & Telegraph Company.

days' aging at 98 ± 2 deg. C., then a -35 deg. C. cold bend.

TABLE II

COLD BEND AFTER AGING, 10X MANDREL: TWENTY HOURS CONDITIONING

Aging: 14 Days at 80 deg. C.

Temperature	Typical Jacketing Material Pass	Fail	NFD-3000 Pass	Fail
—40 deg. C.	5	0	5	0
—45 deg. C.	5	0	5	0
—50 deg. C.	0	5	5	0
—55 deg. C.			5	0
—60 deg. C.			0	5

Aging: 7 Days at 98 deg. C.

Temperature	Typical Jacketing Material Pass	Fail	NFD-3000 Pass	Fail
—35 deg. C.	4	1	5	0
—40 deg. C.	2	3	5	0
—45 deg. C.	0	5	5	0
—50 deg. C.			3	2
—55 deg. C.			0	5

Another interesting observation was the type of cold bend failure. The NFD-3000 merely cracked while the old material shattered, indicating a rapid change in stiffness with temperature. This can be illustrated by the difference in stiffness index (the ratio of stiffness at -50 deg. C. to that at 23 deg. C.); the NFD-300 has an index of less than ten while the old material is well above 125. A plot of stiffness is psi versus temperature illustrates this visually in Figure I. This higher stiffness index for the typical material can cause some installation difficulties because of rapidly changing physical properties with temperature, while the higher stiffness for NFD-3000 means fewer supports and greater strength and dimensional stability without sacrificing low temperature flexibility.

★ ★ ★

There are several other tests that serve to illustrate the superior strength and toughness of this new material. The most obvious is a stress-strain plot for the new and typical jacketing materials and a comparison of moduli of elasticity, or, more accurately, the secant moduli at 5 per cent elongation. The higer values of modulus for the NFD-3000 in Figure II indicates greater ability to resist yielding under load.

★ ★ ★

Durometer readings are an indication of toughness, e.g., hardness, and penetration or instantaneous cut through. Table III shows the comparison of A and D scale readings for the two materials.

TABLE III

DUROMETER READINGS

Scale Material	A	D
NFD-3000	98	54
Typical Non-Contaminating Jacketing Material	77	18

★ ★ ★

The compressive strengths of the old and new material as measured by the load required to crush two inches of insulation on wire are shown in Table IV. The results illustrate the superior strength of the NFD-3000.

TABLE IV

COMPRESSIVE STRENGTH, PSI

Construction Material	8 Mils on A.w.g. No. 20	2/64 in. on A.w.g. No. 14
NFD-3000	600	2170
Typical Non-Contaminating Jacketing Material	390	1310

★ ★ ★

Abrasion tests, which generally yield ambiguous results, in this instance serve as another toughness indicator. The apparatus illustrated in Figure III was used to obtain a comparison between the new material and existing jacketing compounds. The wire (A. w. g. No. 14 coated with 2/64 in. of insulation) is drawn back and forth over a hardened steel square-edged rod. A weight attached to the end of the wire maintains tension and keeps the wire and the topside of the rod at 45 degrees. Table V shows the results in cycles to failure for different weights attached to the wire. These results indicate that a definite improvement in abrasion

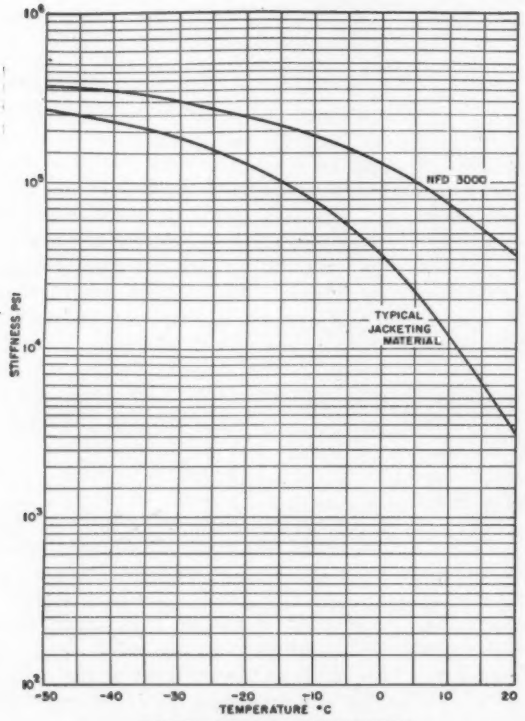

FIGURE I - STIFFNESS VS. TEMPERATURE

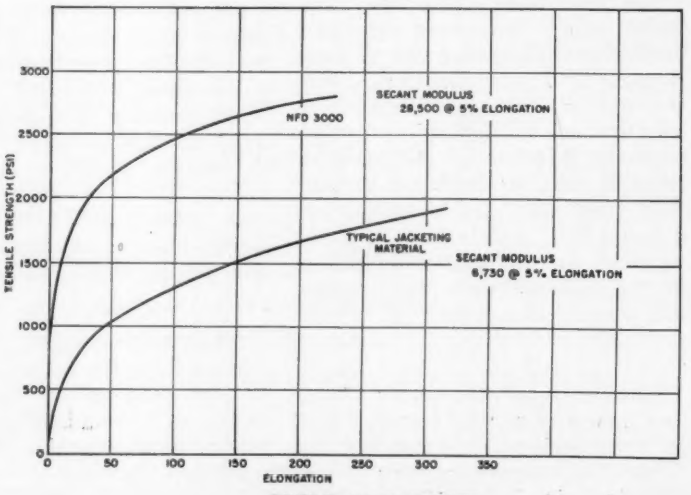

FIGURE II - STRESS VS. STRAIN

resistance can be realized by using NFD-3000.

TABLE V

ABRASION TEST

Cycles To Failure

(Construction: 2/64 in. of Insulation on A.w.g. No. 14 Wire)

Weight, lbs.	5	7	10
NFD-3000	157	55	21
Typical Jacketing Material	102	29	15

* * *

wire on a flat bearing plate, setting a 1/8 in. plate with a round edge perpendicular to the wire, loading this plate through a lever arm, and timing the failure for a given load. Figure V shows the length of time to failure at given loads on the knife for the typical jacketing material and for NFD-3000. As in the other tests, the new material is superior.

* * *

thirteen seconds. The two Bunsen burners were removed immediately after the second picture was taken. The typical material on the left extinguished itself shortly after the third picture while the NFD-3000 extinguished itself immediately after removal of the flame. Since samples of the typical material on A.w.g. No. 14 wire and pressings are not self-extinguishing, it is believed that the braid conducted most of the heat away,

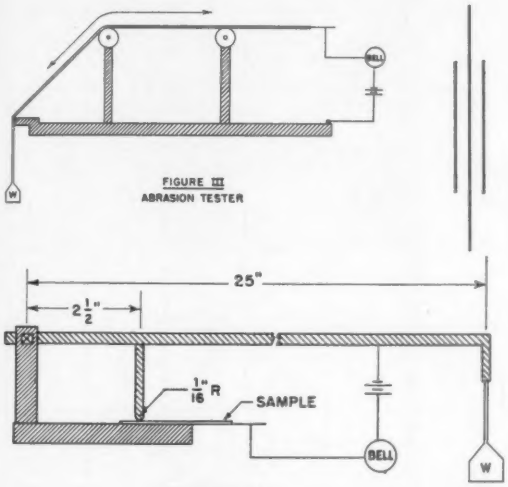

FIGURE III
ABRASION TESTER

FIGURE IV
PENETRATION TESTER

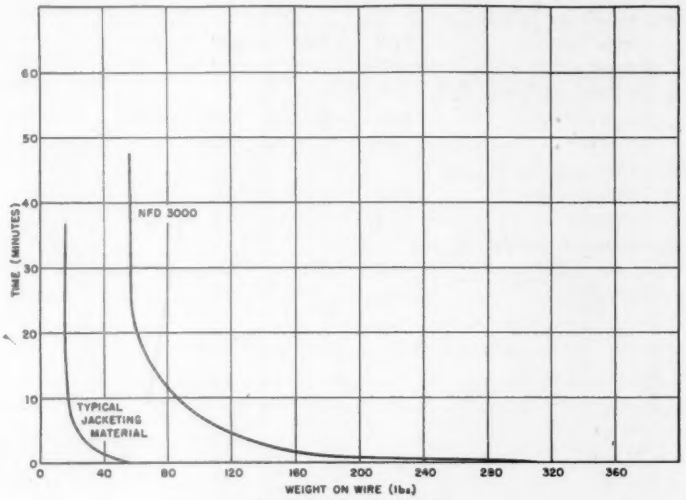

FIGURE V – PENETRATION TEST
TIME TO FAIL VS. LOAD ON WIRE

One more very important indication of toughness is the penetration test which illustrates such characteristics as deformation cut-through, and cold flow resistance. The test was conducted on A.w.g. No. 14 wire coated with 2/64 in. of insulation, using the apparatus illustrated in Figure IV. The penetration test is run by placing a

Another interesting property of NFD-3000 is its non-flammability. A test was conducted on two samples of RG-17A/U, one jacketed with the typical material, the other with NFD-3000. Figure VIa shows the two cables after thirty seconds in a Bunsen burner flame, Figure VIb at two minutes and Figure VIc at two minutes and

thus assisting in extinguishing the typical material. The low amount of vinyl chloride in the typical material accounts for the difference in test results.

* * *

Two other physical characteristics of interest are fungus resistance and weatherability. Inasmuch

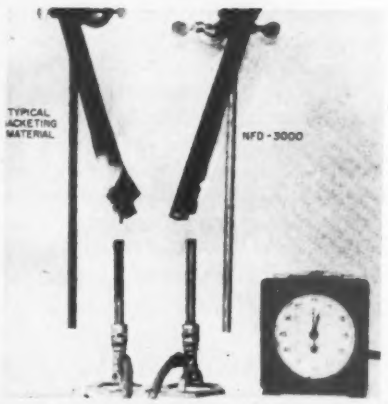

Figure VIa—Burning Characteristics of Typical Jacketing Material and NFD-3000. * * *

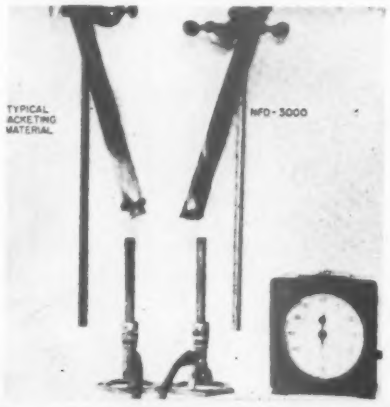

Figure VIb—Burning Characteristics of Typical Jacketing Material and NFD-3000. * * *

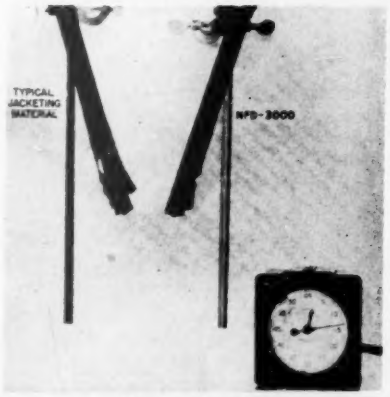

Figure VIc—Burning Characteristics of Typical Jacketing Material and NFD-3000. * * *

as the new material is devoid of plasticizer, it should be as fungistatic as rigid vinyl. Accelerated weathering data indicates that the material is superior to common vinyl materials of equivalent hardness.

wire insulation after various agings. This table shows a comparison of NFD-3000 with the typical jacketing material in two different constructions.

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be made over both the typical jacketing material and plasticized vinyls. Figure VII shows the variations of dissipation factor and dielectric constant at 25 deg. C. with frequency for the two jacketing materials and a typical plasticized vinyl compound. The sharp increase in dissipation factor at low frequencies for the typical jacketing material is caused by its low resistivity, which is several thousand times less than the NFD-3000. The low dissipation factor and dielectric constant may suggest other applications. The direct current resistivity plotted against temperature is shown in Figure VIII. NFD-3000 is roughly four cycles above the typical jacketing material and two cycles above most plasticized vinyls.

TABLE VI

TENSILE STRENGTH AND ELONGATIONS

Material	NFD-3000		Typical Jacketing Material	
Construction	8 Mils on A.w.g. No. 20	2/64 in. on A.w.g. No. 14	8 Mils on A.w.g. No. 20	2/64 in. on A.w.g. No. 14
Original Tensile Strength	3350	2970	1780	1830
Original Elongation	175	190	160	355
Aged 4 Days at 136 deg. C.				
Tensile Strength	5190	3430	7630	5640
Elongation	200	215	0	125
Aged 5 Days at 120 deg. C.				
Tensile Strength	5270	3670	7650	2330
Elongation	205	215	<50	260
Aged 10 Days at 120 deg. C.				
Tensile Strength	5960	5440	6800	2300
Elongation	<50	<50	<50	<50
Aged 7 Days at 100 deg. C.				
Tensile Strength	4300	3390	1780	1810
Elongation	190	195	190	275

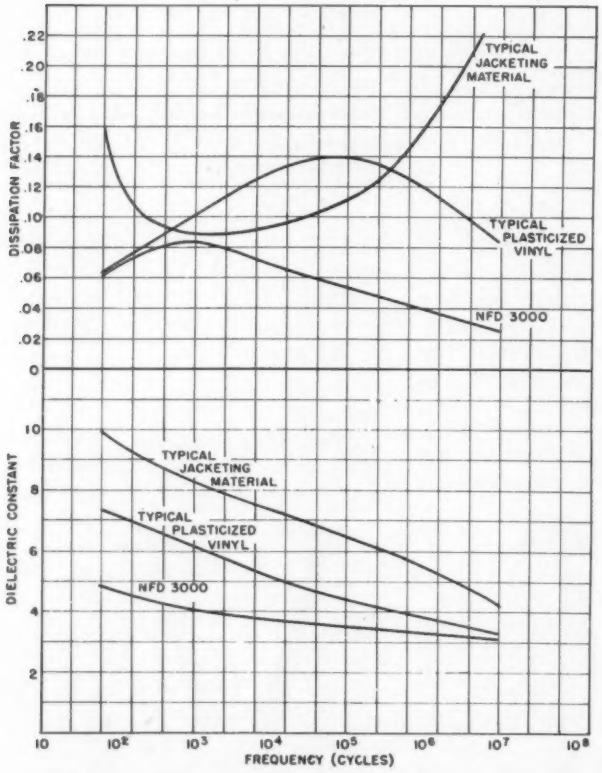

FIGURE VII - VARIATIONS OF DISSIPATION FACTOR AND DIELECTRIC CONSTANT WITH FREQUENCY AT 25 DEG. C.

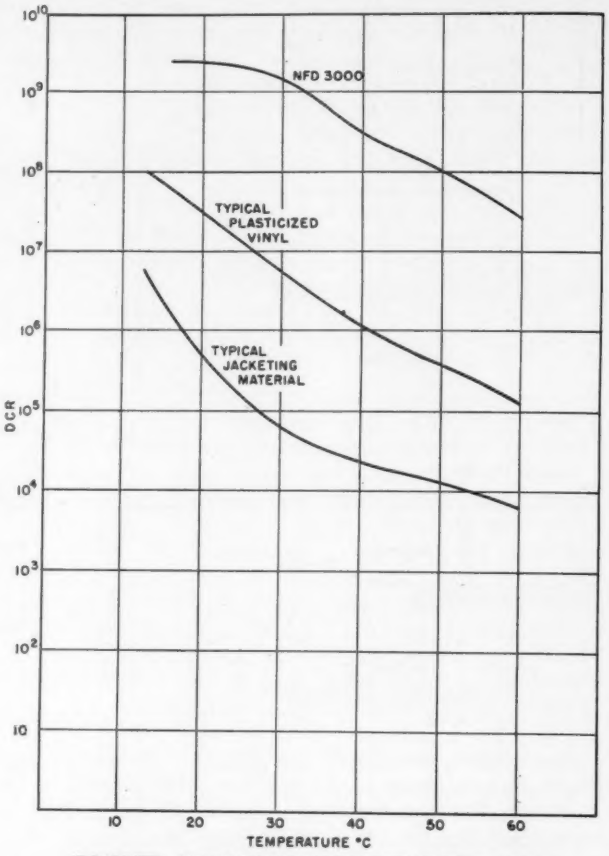

FIGURE VIII - DIRECT CURRENT RESISTIVITY VS. TEMPERATURE

Since the heat aging properties of a new material are quite important, Table VI shows the tensile strengths and elongations of

Although the electrical properties of a jacketing material are not very important in this application, a considerable improvement can

★ ★ ★

It is clear that NFD-3000 offers a number of demonstrated tech-

(*Please turn to page* 1040)

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Quality Control "From Ore to Customer"

Canada is growing rapidly as an industrial community and to keep pace with its mounting needs, Canada Wire and Cable is adding constantly to its production facilities. This article describes the new magnet wire plant.

From the copper mines of Canada's north right through to the finished product shipped from the new Simcoe magnet wire division plant at Simcoe, Ont., **Canada Wire and Cable Company Limited** keeps a constant eye on the end result to maintain top grade standards. Every step along the way from the Montreal rolling mill of the company through the ultra-modern 113,000 square feet of plant at Simcoe, quality control is uppermost in the minds of the staff and workmen.

★ ★ ★

At the company's Leaside, Ontario, plant some 10 per cent of the production needed the highly specialized requirements for producing enamelled magnet wire. Only by building a separate plant devoted to achieving this specialization could the quality product meet the rigid standards of its engineers. The design and development work, therefore, behind the construction of the completely new manufacturing equipment installed at Simcoe had two basic aims:

1) **To produce a better quality product**
2) **To improve manufacturing efficiency**

★ ★ ★

The goal of producing better quality has been achieved through having the latest equipment designed to reduce manufacturing variances and to be capable of utilizing new materials and techniques. The result of these new methods and thinking has been more versatility (in the dozens of variations of magnet wires in normal production) and better quality from that complex production.

★ ★ ★

To achieve the goal of efficiency, the equipment was designed to operate at higher speeds, handle larger packages and operate with less labour effort . . . although in no way reducing labour, for although all the latest safety and control devices have been installed, the operator is still of first importance.

Production by Departments

To offer a brief glimpse of the Simcoe plant, here is a quick word tour of some of the highlights of production. The 113,000 square feet of plant is divided in approximately the following way: wire drawing department, 23,400 sq. ft. or 25 per cent; the heavy and intermediate enamelling department, 28,800 sq. ft. or approximately 25 per cent; fine enamelling, 17,600 sq. ft. or nearly 18 per cent; fibrous covering department, 2,550 sq. ft.; packaged, finished, stores take up the rest with a variety of services such as shipping, test laboratory, reel and spool storage area, welfare area — locker rooms, etc. — boiler room, sub-station for power, enamel storage, main office and machine shop making approximately 30,000 sq. ft. or 32 per cent.

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In drawing wire there are two basic types of wire — round and shaped. At Simcoe, for the present only, round wire will be produced. In this department are installed the following machines:

1 **new F-13 Syncro heavy wire machine**
2 **new Vaughn 13 die intermediates**
10 **new Vaughn 16 die fine**
2 **Syncro A-A machines for 42 size and finer.**

★ ★ ★

The machines installed at Simcoe for drawing have been designed to handle larger reels and operate at higher speeds than those in the Leaside, Ontario, plant of the company—in fact, probably faster than any in Canada. When wire is drawn at the speeds at which these machines are operating, it places considerable importance on the lubricant at the point where the wire is actually being drawn. Special compounds are used to ensure that the wire is drawn smoothly, evenly and without undue strain. The compounds used for drawing are extremely important and the experience the company has gained over the years in this art, is one reason its magnet wire has been looked upon as the finest produced in the country.

★ ★ ★

The description of the art of compounding for wire drawing could fill this article alone, for the size of the wire will change the compound mixture made up mostly of soaps and fats. How the compound is cooled, how it is mixed and even the method used to pump it to the drawing machine must be carefully controlled by the laboratory to ensure the perfection of the wire product.

★ ★ ★

As the machines are drawing copper only for magnet wire production, careful attention is given to the die set-ups. In general purpose wire, drawing it would be too costly to maintain exact drafting with each die such as is considered desirable for film coating. But with magnet wire drawing, the quality must be the best possible. By maintaining exact wire gauge drafts there is no fracture of the copper and a more uniform smooth surface can be maintained. Buying and maintaining of good diamond dies is a major factor in the control of quality control.

★ ★ ★

New annealing equipment has been installed of such capacity that a long push, low heat anneal can be obtained, which assists in maintaining a softer, more windable wire. All wire for intermediate redraw is annealed.

Wire Coating Department

In the wire coating department 45 ovens have been installed (all except two horizontal ovens are

gas fired):

21 8 ft. vertical fine wire ovens
6 horizontal fine wire ovens
10 16 ft. vertical intermediate ovens
8 20 ft. vertical heavy wire ovens

★ ★ ★

The use of the new pay-off's and take-up's and new mechanical drives give the plant greater average weights of wire on each spool. The use of gas and the unusual height of the ovens permits close control of the heat pattern with higher production speeds, softer finished wire and constant, even baking of the film.

★ ★ ★

In order to produce the desired buildup and smoothness of coating on dip-coated enamelled wire, it is necessary to control the viscosity of the varnish being fed to the enamelling ovens within narrow tolerances. To attain this control, the enamel system comprises recirculating, heating and viscosity control equipment which regulates the supply of solvent to the system.

★ ★ ★

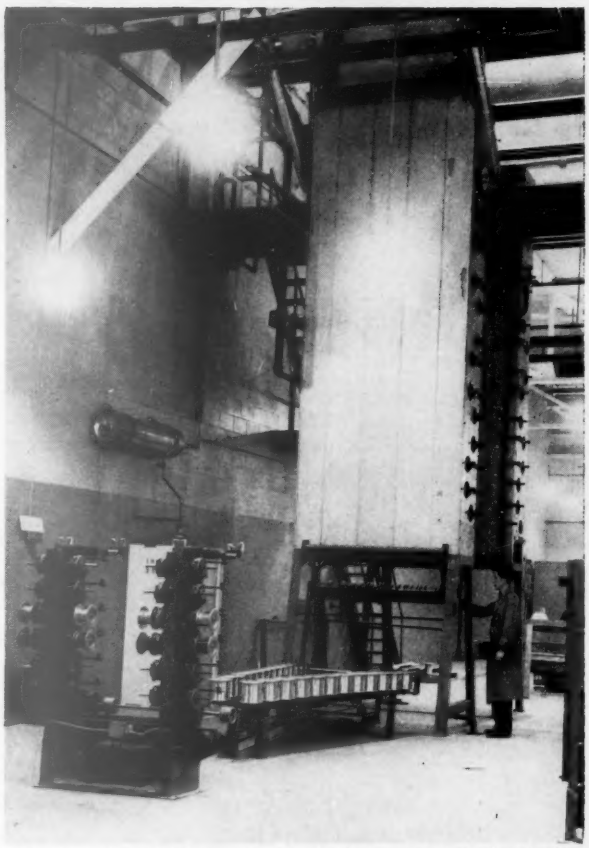
Three systems are installed at Simcoe, one for heavy wire, #19 or larger, one for intermediate wire sizes #20 to #30 and one for fine sizes #3 and finer. These systems are sealed and protected by inert gas to protect the enamel from oxidation. In addition, improved viscosity and recirculating equipment are more effective in protecting the enamel from contamination and result in an improved quality coating.

★ ★ ★

In the enamelling storage room there are 10 tanks of 3,000 gallons and four tanks of 1,000 gallons with a total capacity of over 30,000 gallons for the storage of wire coating materials. This is something new in Canada and the advantage lies in the large single shipments of raw materials which may be handled. This eliminates much of the variation found from batch to batch in using drum shipments as has been the practice until the adaption of this new system in Simcoe.

★ ★ ★

Each storage tank is connected to an inert gas generator so that the varnishes stored are continually covered by a protective blanket of inert gas. This prevents contamination of the varnish through the action of oxygen at the surface of the material.



Above is a view of the unusual new oven design created by Canada Wire engineers in cooperation with engineers of Essex Wire Corporation of the United States under the guidance of its president, Addison E. Holton.

Inspection and Testing

New inspection and laboratory test equipment installed have given the staff the facilities to evaluate thoroughly the chemical and physical properties of all raw materials and finished products. In addition, the staff are setting up development programs to provide test information to customers in an effort to assist them in choosing Canada Wire products and in the application of them.

★ ★ ★

The latest methods of statistical quality control methods coupled with carefully trained inspection personnel is providing the information on which the quality control program is based.

★ ★ ★

This is only a brief glimpse of some of the highlights of this new modern magnet wire plant. There are so many technical aspects to processes that it would be impossible to cover them all to everyone's satisfaction. The company's engineers have explored every avenue of knowledge and technique in order to have conditions perfect. No detail has been too small for their planning — as witness the fact that the plant is kept constantly at 80°F. to assist in the baking and production of better quality wire. No wire in this plant is touched by human hands; everything is kept covered and sealed from contamination by air and dust. Even the spools are kept covered lest dust accumulate to mar perfection. All the doors and openings of the plant are kept sealed so that no dust can sneak

(*Please turn to page* 1045)

Introducing

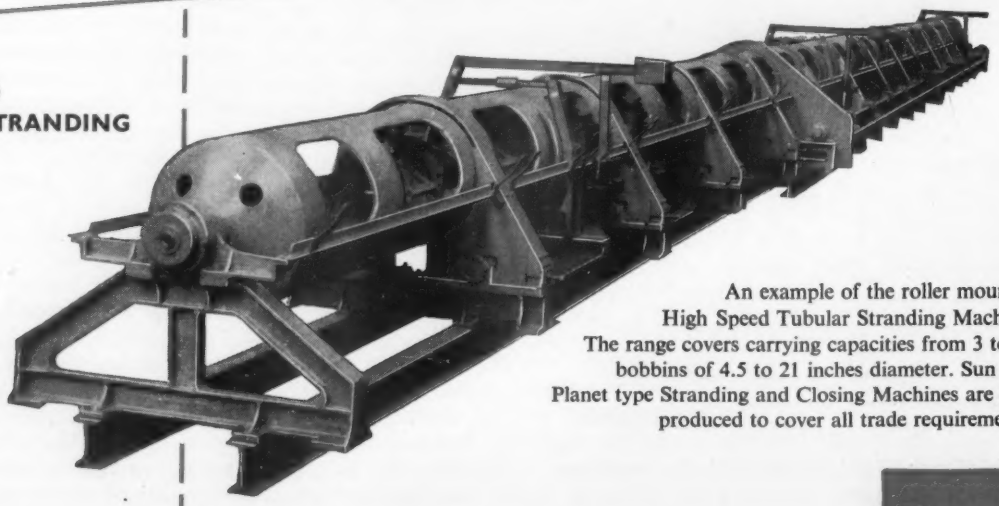
LARMUTH &

BULMER LTD.

In association with Mono Pumps Ltd., J. & E. Arnfield Ltd., Menrow Ltd., Carlisle Electrical Co. Ltd.

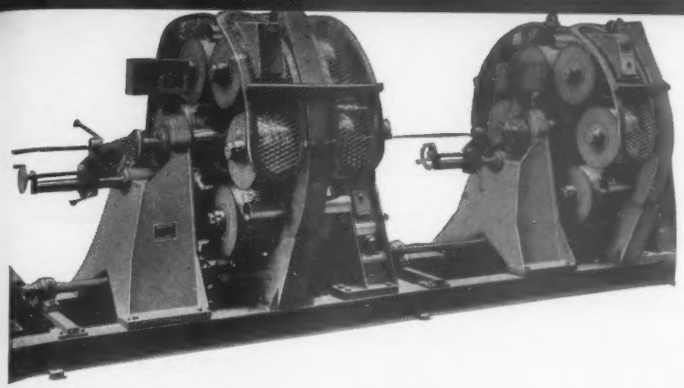
Larmuth & Bulmer of England have been manufacturing rope and cable-making machinery for more than half a century. During this time their skill and experience have produced high quality machines which are used throughout the world today. Now this craftsmanship has been combined with the production resources of a group of British Engineering Companies to provide an export spares and delivery service in keeping with the high standard of their machines. Coupled with this service is the recognition of the need of new machines to meet the growth of the Industry.

HIGH SPEED TUBULAR STRANDING MACHINE



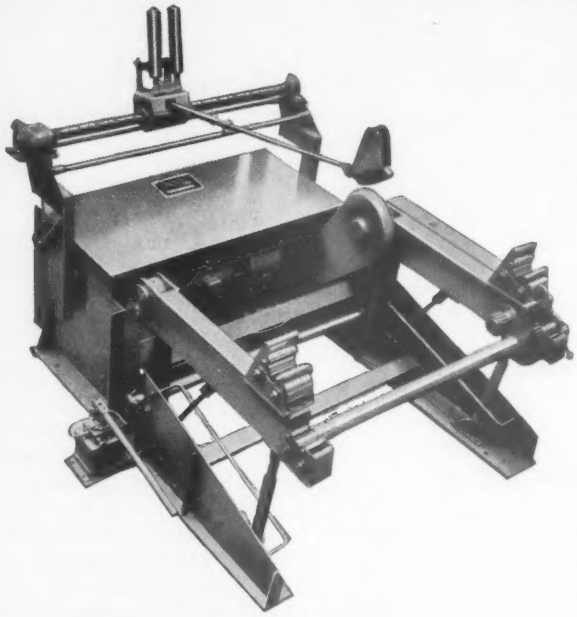
An example of the roller mounted High Speed Tubular Stranding Machine. The range covers carrying capacities from 3 to 45 bobbins of 4.5 to 21 inches diameter. Sun and Planet type Stranding and Closing Machines are also produced to cover all trade requirements.

LB



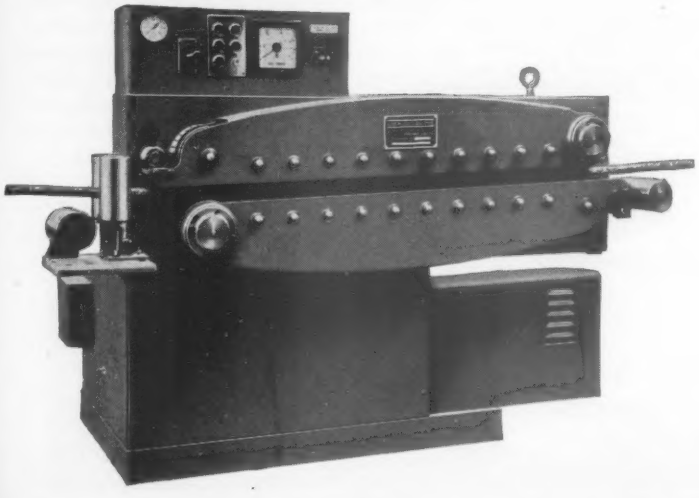
FIXED BOBBIN STRANDING MACHINE

The Larmuth & Bulmer Fixed Bobbin Stranding Machine produces high quality stranding at 50% higher speeds than the Sun and Planet method. Initial costs are low. Floor space is saved. Maintenance is reduced. Many automatic refinements are introduced.



INDEPENDENT TAKE-UP DRUM STAND

This Larmuth & Bulmer independent Take-up Drum Stand can be transported from one machine to another. A new traverse action automatically coils without the aid of the usual standby labour. Cable tension and stop mechanism is electrically controlled to dispense with the friction clutch method. Loading is eased by a hydraulic system.



CATERPILLAR HAUL-OFF

The Caterpillar Haul-Off uses endless belts of rubber shoes which fully protect the cable during haul-off. Grip may be pre-selected and simply controlled. It is positive and constant throughout operation. The unit does not require special foundations or the usual haul-off drum pit. It can be used as a reliable independent measuring device.

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Studies in Electroless Plating

A summary of a technical report of the National Bureau of Standards in Washington, D. C.

Increased understanding of the conditions favoring "electroless plating" has resulted from recent research at the National Bureau of Standards. This chemical deposition process[1] for plating nickel and cobalt on metal surfaces, was developed a decade ago by the Bureau. It is similar in many respects to electroplating but does not employ an electric current. Although adapted by a number of industries for specific applications, electroless plating has not been systematically studied to any great extent. Thus, to obtain further information on the nature of the deposition, C. de Minjer[2] and A. Brenner of the Bureau's electrodeposition laboratory have been investigating the variables that effect the rate of nickel plating and the degree of protection that the coating provides.[3]

★ ★ ★

Unlike electrodeposition, electroless plating can be used to build up smooth, uniform coatings to a definite thickness over irregularly shaped objects without producing nodular deposits on edges and corners. In other chemical processes for metallic films, the depositing metal is randomly distributed over the container walls as well as over the objects immersed in the solution. Also, after several minutes, the reaction runs to an end and the exhausted solution must be discarded. With the electroless process, however, a nickel coating is deposited only on certain catalytic metals, such as iron, nickel, cobalt, and palladium; deposition does not occur elsewhere in the bath. Furthermore, by periodically replenishing the bath with the appropriate chemicals, the system can be run continuously for hours or even days. Since the reaction is autocatalytic, that is the nickel itself catalyzes the process, the deposition continues once a nickel surface is obtained on any object. Non-catalytic metals can be made catalytic by immersion in a dilute solution of palladium chloride, which coats the metal surface with an almost invisible film of catalytic palladium.

★ ★ ★

Electroless nickel deposits are not pure nickel but consist of a nickel-phosphorus alloy containing about 8 percent phosphorus. The deposits are bright and much harder than pure nickel deposits.

★ ★ ★

The electroless process involves the reduction of hot nickel salt solutions, such as the chloride or sulfate, with pure sodium hypophosphite. An organic acid, such as glycolic or citric acid, is added to the bath as a combined buffering and complexing agent. Actually the reaction utilizes only about one-third of the hypophosphite reducing power because a concurrent reaction between the hypophosphite and water produces hydrogen and phosphite.

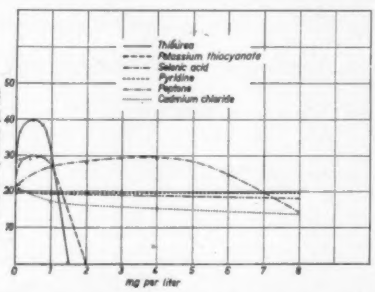

Figure 2. Graph showing the influence of various substances on the rate of electroless nickel plating. These compounds, which normally inhibit the chemical reaction accelerate the process when added in minute quantities. With thiouria, a maximum rate almost twice that of the corresponding bath without the inhibitor is reached. Selenic acid yields a somewhat broader maximum than either the thiourea or potassium thiocyanate. Pyridine had little effect on the rate while cadmium chloride caused the rate to decrease steadily with the concentration. * * * *

★ ★ ★

Experiments were conducted on the rate of deposition at various values of pH. The originally developed electroless bath deposited coatings at the rate of only a few tenths of a mil per hour and rates of the order of 1 mil per hour were desirable. Although the acidity increases during operation of the bath, it was not feasible to control the pH during the plating. Instead, a relatively large volume of the bath (1 liter), was used to plate a relatively small specimen (having an area of only 12 cm^2). Under these conditions, the change in hydrogen ion concentration was not significant.

★ ★ ★

An increase in the acidity of the bath considerably reduced the rate of plating. For example, a decrease in the pH of the bath from 5 to 4 halved the rate. Ordinarily a higher pH could be maintained by continually adding alkali but the upper value of the pH is limited by the precipitation of nickel phosphite. This reaction is undesirable because the presence of a precipitate leads to spontaneous decomposition of the bath. Thus, the optimum pH of the electroless bath is limited at the lower level by the decrease in the rate of nickel deposition and at the higher level by the diminishing solubility of nickel phosphite. The most satisfactory pH for the acid bath was found to be between 4 and 4.5.

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(*Please turn to page* 1041)

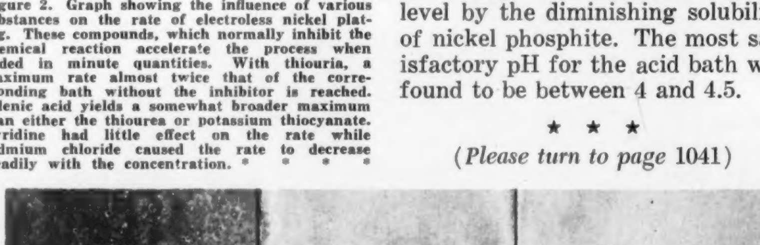


Figure 1. The effect of weathering on electroless nickel plating as compared to other types of nickel-coated steels. In studies conducted at the National Bureau of Standards, the electroless nickel plate (b) withstood the 15-month exposure with very little corroding, as did the electrodeposited nickel coat with 9 percent phosphorus (c). However, the electrodeposited sample (a) rusted markedly. * * * * * * * * * * * * * * *

Aluminum for the Electrical Industries

by Irving Lipkowitz
Assistant to the President
Reynolds Metals Company
New York, N. Y.

The aluminum and the electrical industries are old friends. Aluminum has been a big consumer of electrical power for more than 60 years. About 20,000 KWH are used in producing a ton of primary aluminum. In 1955 over 31 *billion* KWH were used in primary aluminum production (1,566,000 tons). This power consumption is 26% as much as the nation's total residential consumption of 120.5 billion KWH in 1955.

Electrical Markets for Aluminum Are Growing Rapidly

Now the electrical power and electrical manufacturing industries are also rapidly becoming big customers of the aluminum industry. Electrical markets for aluminum have been growing sharply, from 133,500 tons in 1950 to 220,000 tons in 1955. By 1960, the electrical market for aluminum is expected to be at least 350,000 tons, or 59% higher than last year and 162% higher than in 1950.

* * *

The covered wire and cable section of this market is also expanding rapidly, having increased from 11,700 tons in 1952 to an annual rate of 26,000 tons by the end of 1955, a 120% jump in three years' time.

Ample Resources for Continued Expansion of Aluminum Supply

The expansion of aluminum supply depends on the availability of three resources: ore, electric power and financing.

* * *

The industry's ore position is very favorable. Aluminum is the most plentiful metal ore in the world, making up one-twelfth of the earth's crust. Because of aluminum ore's abundance, the industry has been able to fill all of its production requirements with ores having an average aluminum content of 25%. By contrast, copper ores now being mined in this country have an average copper content of only 0.85%. Beyond the high grade aluminum ores now being used are vast domestic clay deposits (estimated in billions of tons) which also have a relatively high aluminum content. Consequently, the long range outlook is for an ore supply so abundant that it does not impose any raw material limitations on the expansion of aluminum production in the United States.

This is an outline of a talk given by the author at NEMA's Wire and Cable Section Meeting at the Westchester Country Club, Rye, N. Y., in April, 1956. It is published here with his kind permission and that of NEMA.

* * *

The power supply picture is also bright. Prior to World War II, all primary aluminum production in this country was dependent on hydro power. Since World War II, natural gas (also lignite) has been used much more than hydro as a source of power for aluminum production. New capacity now under construction and to be built during the next few years will use electric power produced from coal to a large extent. With natural gas and coal becoming additional regular sources of electrical energy for aluminum production, there is consequently no power bottleneck blocking the further expansion of the aluminum industry.

* * *

With neither ore nor power supply putting a ceiling on aluminum expansion, one industry leader recently explained that "only time and money are needed to expand aluminum supply," time to build a plant and the money to finance it.

Financing is an important condition because the capital requirements of aluminum producing facilities are heavy. About $1500 must be invested per ton of new capacity from the mining through the pig stage, including power facilities. This is five times as much per ton as the steel industry requires for comparable producing capacity.

* * *

As to aluminum's production record, it compares as follows with industrial production generally and with copper in particular:

(*See Production Table*)

* * *

Aluminum's greater expansion in production and supply brings with it another advantage — a larger share of the aluminum supply originates with the domestic aluminum industry. In 1955 about 88% of the total aluminum supply consisted of domestic primary production or new scrap generated by fabricating and manufacturing plants. About 68% of the copper supply came from similar sources. As a result, only 12% of the total aluminum supply came from outside sources, imports or old scrap, while 32% of the copper supply was dependent on such outside sources.

* * *

A look at the future supply indicates that aluminum will continue to outpace other metals. Capacity under construction and already planned will increase United States aluminum capacity 755,000 tons by the end of 1958, or 46%. Copper expansion in the United States during the same period will be about 148,000 tons, or 13.6%. On a world-wide basis, aluminum expansion will be about 1,358,000

(*Please turn to page* 1039)

New Low-Cost Non-Returnable Reel Offers All Features of Expensive Returnable Reels

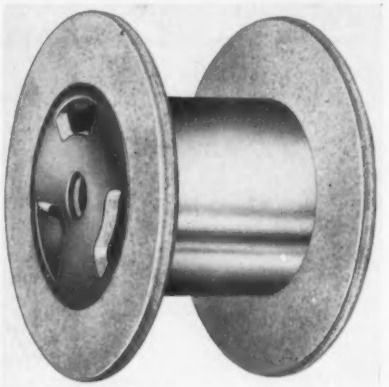
As a direct answer to the wire industry's need for a low-cost non-returnable reel of exceptional quality, **Acrometal Products, Inc.** of Minneapolis has produced a completely new and unique reel—rated non-returnable, yet incorporating all the features of strength, accuracy and balance generally associated with more expensive returnable reels.

★ ★ ★

This new reel has a heavy guage steel barrel and steel reinforcing end plates, slotted for easy hand lifting, and represents exceptional strength and durability. The assembly is welded, and the arbor hole is reinforced as well as steel bushed.

★ ★ ★

Phenolic flanges resist wear, absorb shocks, and take considerable abuse without breaking or cracking. Smooth flange periphery assures easy removal over the head without snagging and permits packaging finer guages of wire on larger packages. In fact this is one of the significant reports from the field about this reel. Manufacturers of fine wire, both ferrous and nonferrous, report that they are able to package finer wires in greater volume on this reel than has been possible on any other type of reel to date.



New Acrometal Reel.

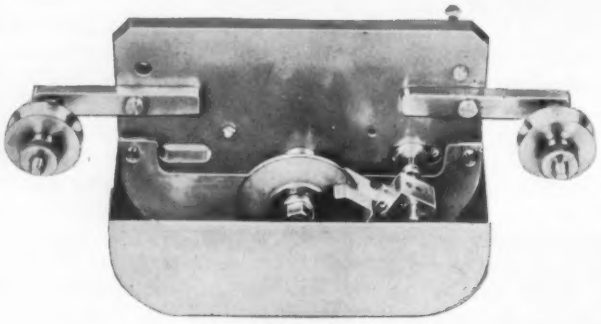
Experimentation with this reel started last fall when **Fred Bieber,** president of Acrometal Products, had some hand-made samples made up to show to the industry. Within a matter of a few days they had orders for several carloads. The reel has been test-running in the industry since the first of the year, with excellent acceptance both from wire manufacturers and wire users.

★ ★ ★

In addition to being precision accurate and true running, this reel was planned to help the wire manufacturer in still another way: The flat flange surfaces permit **palletizing** the packaged wire—and palletized shipments reduce unloading, storage and handling costs.

★ ★ ★

The company states that this reel fits any present spooling equipment. There is, therefore, no need for adapters or back-up plates. Reel is available in a series of standard sizes conforming to individual factory needs.



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ASTM Standards Actions

Among the recent actions affecting the wire industry are the following:

★ ★ ★

Uncoated Stress-Relieved Wire for Prestressed Concrete (A 421 — 58 T):

The steadily increasing use of prestressed concrete has resulted in a great need for industry wide standards governing the production and purchase of the steel cable and wire used for prestressing. Last year the Tentative Specification for Uncoated Seven-Wire Stress-Relieved Strand for Prestressed Concrete was published to cover the cable. The steel wire is covered in the present specification. Two types of wire are included, one intended for anchoring by cold end deformation and the other for anchoring by wedges.

★ ★ ★

Half-Hard Aluminum Wire for Electrical Purposes (B 323 — 58 T):

Last year the Underwriters' Laboratories expanded the range of tensile strength permitted for intermediate temper aluminum wire from 17,000 to 22,000 psi, to a new 15,000 to 22,000 psi range. This was done because some users preferred a more ductile wire for smaller size building wires whereas other users preferred the stronger temper for larger cables for duct and conduit installation. Accordingly the new specification is recommended to supplement the present Specification B 262 for three-quarter-hard wire.

★ ★ ★

Rectangular and Square Bare Aluminum Wire for Electrical Conductors (B324 — 58 T):

During the last few years there has been growing commercial interest in rectangular and square aluminum wire for use as magnet wire. About three years ago the committee noted the trend and started to develop suitable specification requirements, as part of its continuing program of developing specifications for several particular types of aluminum conductors.

For Moisture Resistance, Specify

TEXTILENE

TWI-FLEX and TWI-WAX

Treated to reduce wicking and prevent leaching, lightly waxed Textilene Twi-Flex and heavily waxed Textilene Twi-Wax provide effective resistance to moisture. Both fillers are extensively employed for non-metallic sheathed cable (building wire), maritime shipboard cable, varnished cambric cable, and underground service entrance cable.

Twitchell's superior Textilene line also includes: Soft, dry fillers — *Twi-Port* and *Glascor** (Fiberglas-centered for high tensile strength without added bulk). Used for control, power, appliance, coaxial and communications cables, and all portable and flexible cords.

Fungus-resistant filler — *Twi-Tar*. Used for buried communications cable, expanded ACSR cable, and in other applications.

*Patent Applied For

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Tentative Method of Test for Dielectric Constant and Dissipation Factor of Polyethylene Under Liquid Displacement (D 1531 — 58 T):

New Tentative.—This method provides procedures that are particularly suited to the precise determination of the dielectric constant of polyethylene compounds, in the vicinity of 2.28, at frequencies from 1000 cycles to 1 Mc and at a temperature of 23 C (73.4 F). It may be extended to cover a dielectric constant range from 2.00 to 3.00. It covers a dissipation factor range from 0.0001 to 0.1. The new principal of measurement which the method employs is an improvement over the direct electrode method of ASTM Methods of Test for A-C Capacitance, Dielectric Constant, and Loss-Characteristics of Electrical Insulating Materials (D 150).

★ ★ ★

Tentative Methods of Testing Hydrocarbon Waxes Used for Electrical Insulation (D 1168 — 54 T):

Revision.—Method of Test for Penetration of Bituminous Materials (D 5 — 52) has been found unsuitable for measuring penetration of wax, and reference to this method has been replaced by reference to the Method of Test for Needle Penetration of Petroleum Waxes (D 1321 — 57 T). Additions are also made to the scope statement.

Notes on Research Firm's Progress

About a year and a half ago a new metallurgical research and development laboratory, **Metals Research and Development, Inc.,** was set up in Exeter, Penna., (located between Wilkes-Barre and Scranton) under the leadership of **Samuel Storchheim,** a metallurgical engineering executive, formerly Chief of Nuclear Manufacturing Engineering and Research with the Martin Company of Baltimore, now President and Technical Director of the new firm.

★ ★ ★

The laboratory was opened on March 4, 1957, with three engineers and the first experimental

studies undertaken. Following this, contracts received from both private businesses and government agencies were such that both staff and working areas had to be increased substantially.

★ ★ ★

Facilities encompass pilot plant operations and it is anticipated that a number of the projects being worked upon shortly will be translated into large-scale production.

High Frequency Equipment Bulletin from Louis Allis

The Louis Allis Co., 427 E. Stewart St., Milwaukee 1, Wis., has recently published a twelve page bulletin, No. 2250, on "High Frequency Equipment."

★ ★ ★

This bulletin points out the value of high frequency equipment as a means of increasing the output or efficiency of present-day high production machinery that is often limited by standard 60 cycle power. It also stresses that drivemotors operating at above-line frequencies can be built smaller, lighter and are often less expensive than standard drivemotors.

★ ★ ★

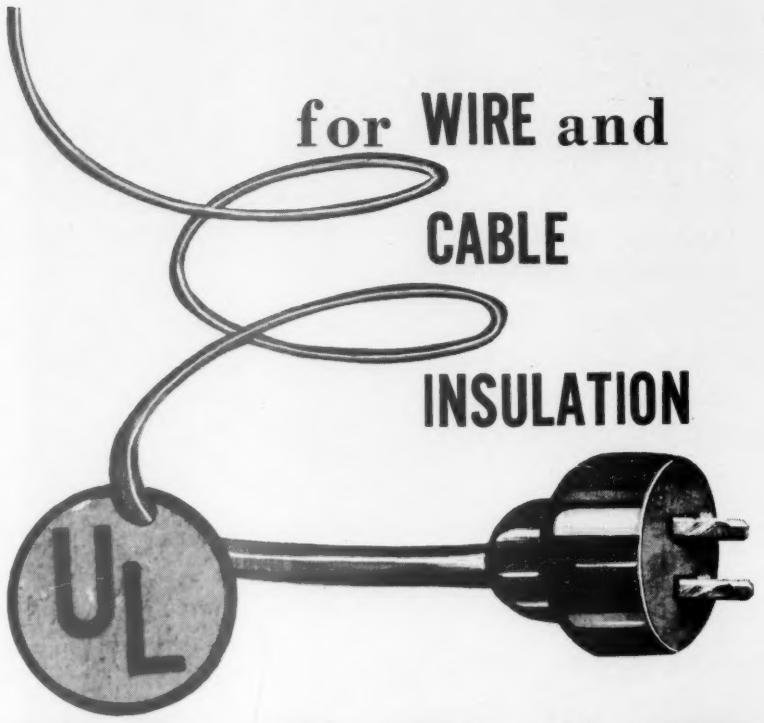
Application and engineering information is given on two types of high frequency power supplies: Induction Frequency Converters and Motor-Alternators.

Instruction Sheets on Cobalt

Two new instruction sheets on metallographic etching reagents for cobalt and its alloys and electrolytic polishing of cobalt are available from the Cobalt Information Center.

★ ★ ★

"Metallographic Etching Reagents for Cobalt and Cobalt-Containing Alloys" provides four pages of macroetching and microetching instructions. Information is supplied on the correct etching solution and method for various high-temperature alloys, high-speed steel, sintered carbides, hardfacings, and pure cobalt, together with appropriate remarks on each operation. Industrial alloys listed include Ni-



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CARY CHEMICALS, SPECIALIZING IN THE WIRE COVERING FIELD, OFFER TWO OUTSTANDING PVC COMPOUNDS — PROVIDING MAXIMUM PROCESSABILITY, FAST EXTRUSION AND UNIFORMLY HIGH QUALITY.

BLACAR® 2700: UL-approved primary insulating material designed for low cost building wire applications—specifically: T, TW, TF, TFF, type wire (including oil exposure at 60°C).

Provides excellent processing features, high extrusion rates, good electrical properties, plus a smooth glossy finish. Ideal for use as a general-purpose material for a wide range of low-tension wires and cables.

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If your needs are special—Cary can modify existing formulations or custom-formulate to the most exacting requirements.

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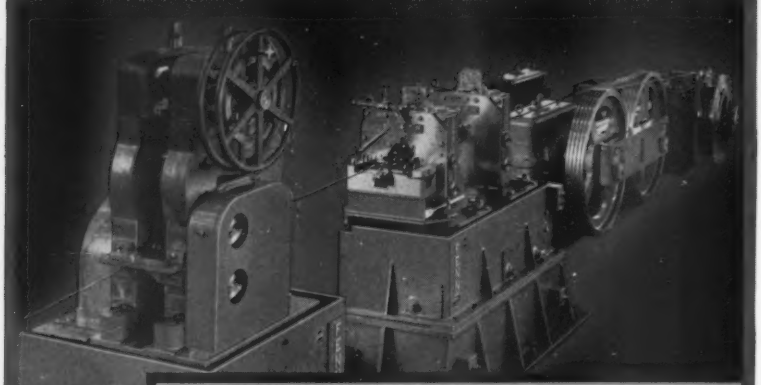
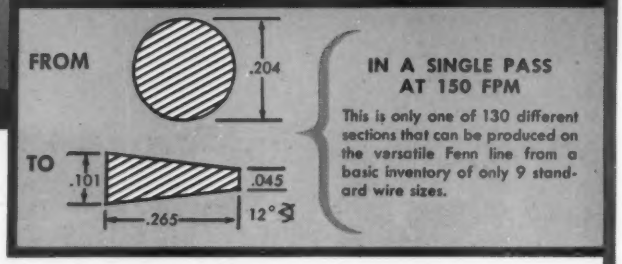
FENN *Precision*

Copper Commutator Bar Line

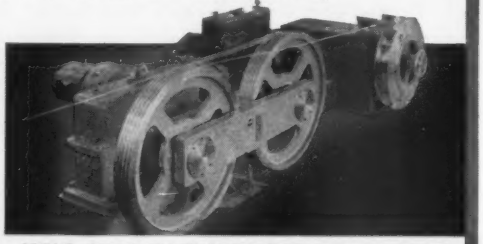



FROM
.204
TO
.101
.045
.265
12°
IN A SINGLE PASS AT 150 FPM
This is only one of 130 different sections that can be produced on the versatile Fenn line from a basic inventory of only 9 standard wire sizes.

This Fenn line accomplishes several important objectives, in both product and economics. Most important is its flexibility which permits the manufacture of 130 different bar sections from only 9 standard wire gauges . . . substantially reducing basic material inventories . . . and with better quality control. Stock savings alone will amortize its cost in a very reasonable length of time. The basic function of the line is to take coils of round copper wire and form it into a trapezoidal shape of precise tolerances and rewind it at the other end.

The line consists of a Pay-Off Reel, a Model 2U Turks Head mounted to a Model 084 Two-High 8″ diameter Rolling Mill, a Model 1244 Wire Shaping Mill with Friction Two Roll Edger, a Model 42 Double Capstan, and a Model 1205 Hydraulic Traversing Take-Up Reel.

The installation of a Fenn line can also have important product and economic considerations in your plant. Write for full information or catalog.



ABOVE—Fenn Model 42 Double Capstan serves as power source for pulling bar stock through wire shaping mill.

LEFT—Fenn Model 1244 Shaping Mill with tandem mounted 4TH Turks Head incorporating shaped rolls.

Fenn Manufacturing Company • 603 Fenn Road • Newington, Conn.

monic 90, Nimonic 100, HS-21, HS-23, HS-25, HS-27, HS-30, HS-31, HS-36, N-155, and S-816.

★ ★ ★

"Electrolytic Polishing of Cobalt" lists eight solutions for use in chemical and electrolytic polishing of various cobalt alloys. Times, temperatures, and voltages are specified.

★ ★ ★

These publications may be obtained by addressing requests on company letterhead to the Cobalt Information Center, c/o Battelle Memorial Institute, 505 King Ave., Columbus 1, Ohio.

Booklet on Stainless Steel in the Chemical Industry

A completely revised 40-page booklet on the use of stainless steel in the chemical industry is now being distributed by **Allegheny Ludlum Steel Corporation.**

★ ★ ★

The booklet includes special sections on the process industries, the plastics industry, petrochemical industry, detergents manufacturing, the nuclear power industry and others.

★ ★ ★

Simple, easy to follow diagrams and photopraphs are included in the booklet. A special comparative table on stainless steels and a table on the corrosion resistance of Allegheny Ludlum stainless steels to various media are included.

★ ★ ★

A copy of the booklet can be obtained by writing to the Advertising Department, Alleghany Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.

"Better Ways to Package, Unitize, and Ship"

The 18th Edition of this catalog, published by the **Signode Steel Strapping Company,** is full of new ideas to improve packaging and shipping methods in all industries.

★ ★ ★

This helpful pocket size 48-page booklet, free to those interested, describes many new methods of

packaging and unitizing products in all industries, as well as recommended methods for shipping these products by rail, truck or intra-plant handling. Also included in this easy-to-read and informative booklet is Signode's complete line of products, including such new developments as Power Strap Feeders, electric, pneumatic, and manual strapping tools and accessories.

★ ★ ★

A must for anyone who ships, a free copy may be obtained by writing to the Signode Steel Strapping Company, 2600 North Western Avenue, Chicago 47, Ill.

Bulletin on Secondary and Service Drop Cable

A new eight-page bulletin, "Neutral-Supported Secondary and Service Drop Cables," is now available from Rome Cable Corporation.

★ ★ ★

Specifications for both types of cable are given, including scope of use, conductors, insulation, construction, tests and put ups.

★ ★ ★

General information on secondary and service drop cables includes charts showing number of strands, insulation thickness, size and type of messengers, outside diameter, weight, current carrying capacity, breaking strength and standard put ups for service cables from 8 to 1/0 AWG sizes and secondary cables from 2 to 4/0 AWG.

★ ★ ★

The bulletin is punched for notebook insertion. For free copies write to: Publications Division, Rome Cable Corporation, Rome New York. Ask for Bulletin RCP-361.

Handbook of Accident Prevention

The National Safety Council has released the second edition of its "Handbook of Accident Prevention."

★ ★ ★

The 93-page handbook on occupational safety contains such new material as a description of radio-

We're making our own plywood
to give you even better reels!
Due to the ever-increasing demand for our spools and reels, we've had to make our second move in just two years! And in our new and spacious quarters we are manufacturing plywood. Since it's made especially for spools and reels, even better-grade products will result—CARRIS spools and reels, now QUALITY-CONTROLLED from plywood to finished spools and reels!
CARRIS REELS
INCORPORATED
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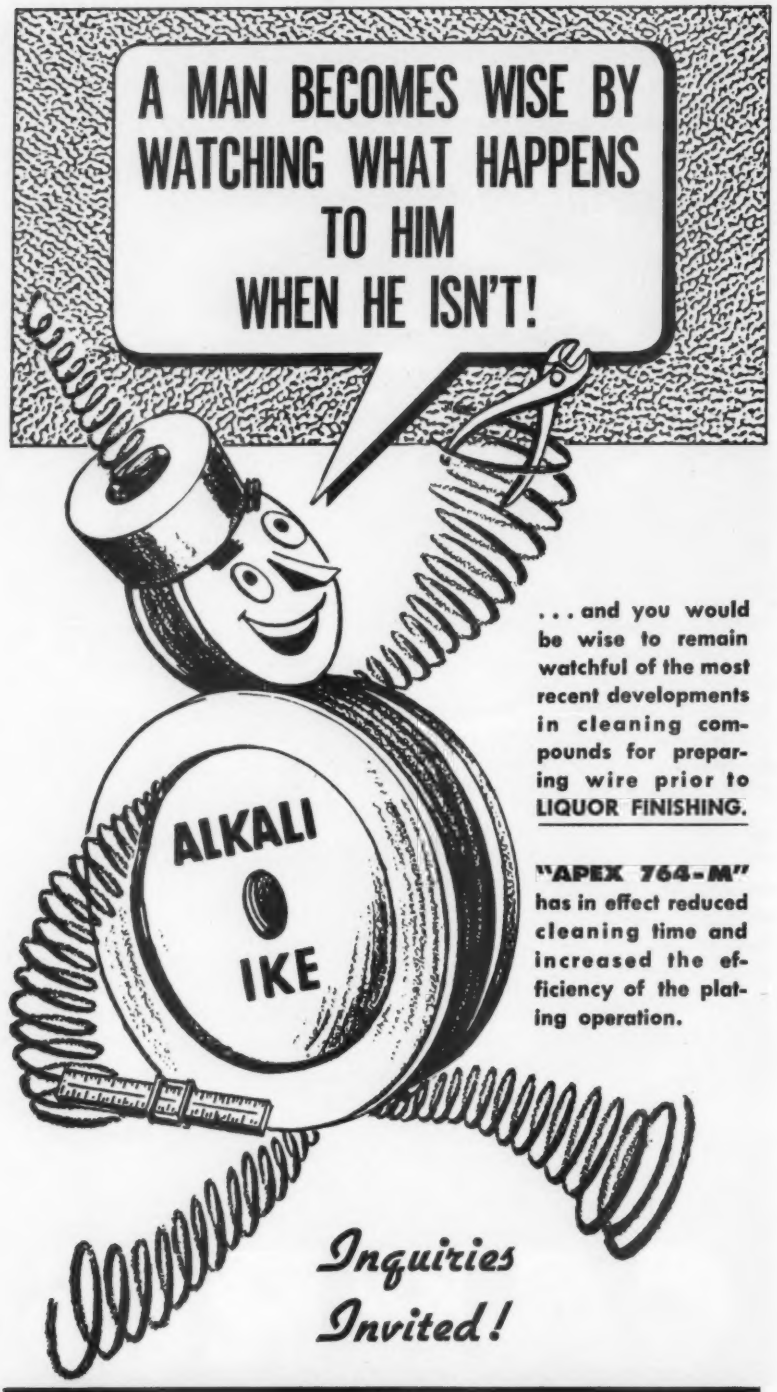


. . . and you would be wise to remain watchful of the most recent developments in cleaning compounds for preparing wire prior to LIQUOR FINISHING.

"APEX 764-M" has in effect reduced cleaning time and increased the efficiency of the plating operation.

Inquiries Invited!

APEX ALKALI PRODUCTS
Company
Lubricants & Cleaning Compounds
for Wire and All Wire Products
Main and Rector Streets Philadelphia 27, Pa.
IV 3-3939

active hazards and ways to protect against them.

* * *

The handbook, according to the Council, is written for small businesses lacking full-time safety specialists. The handbook's style also makes it effective for use by key employees in small organizations.

* * *

With the help of the handbook and the special agencies listed in it, any industrial operations can be made safe, provided management determines to make it so.

* * *

Further information on the "Handbook of Accident Prevention" and information on quantity prices may be obtained from the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

New Bulletin on Air-Break Contactor

Allis-Chalmers high voltage air-break contactors (Type 256A) for control of large motors, primary switching of induction furnace transformers, and other high voltage applications, are described in a new bulletin released by the company.

* * *

Designed for reliable, maintenance-free switching for applications to 5000 volts, these contactors have short arcing time, an important feature in plugging and dynamic braking operations.

* * *

Besides portraying the design features of the contactor, such as a dc magnet with improved operating characteristics, replaceable contact inserts, continuous duty magnetic blowout coils, self-centering movable contacts, etc., the bulletin carries a table of ratings and dimensions for the contactors.

* * *

Copies of "High Voltage Air-Break Contactor (Type 256A)," 14B7303B, are available on request from Allis-Chalmers, Milwaukee 1, Wis.

Announces New Chrome Copper Alloy for High Flex Wire

To meet the needs of industry for an extremely fine wire, highly resistant to vibration and flexing fatigue, **Tensolite Insulated Wire Co., Inc.,** Tarrytown, N. Y., has announced the availability of chrome copper alloy conductors in their complete line of hook-up wire.

★ ★ ★

In measurements made on various types of 26 gauge stranded (7/34) wire, the new alloy showed a tensile strength of 49,000 to 52,000 PSI as compared to approximately 35,000 to 40,000 for silver plated annealed copper. The conductivity of the new conductor was over 90 per cent that of copper. Reinforced strandings of the same size have an average of 50,000 PSI tensile strength and a conductivity of less than 85 per cent.

★ ★ ★

The new chrome copper alloy conductor can be supplied to meet the requirements of MIL-W-16878C and is available on request in any hook-up wire manufactured by Tensolite.

★ ★ ★

Conductors of the new alloy approach commercially pure copper in conductivity, offer the same elongation when annealed, besides possessing a higher tensile and general mechanical strength.

Ratings of Columbia Synchronous Generators Increased

Announcement is made by **Columbia Electric Mfg. Co.,** 4519 Hamilton Ave., Cleveland 14, Ohio of its new Frame 5200 Series Synchronous Generators now available in 900 RPM ratings through 1250 KVA, 0.8 PF, 1000 KW, three phase 60 cycles (and equivalent 50 cycle ratings) in all standard voltages through 6600 volts.

★ ★ ★

This new and larger frame, designed for ease of maintenance, has rigid bracket bearing construction, featuring ball bearings, integral lifting lugs, all welded steel drip-proof construction, baffled ventilating system, full damper (amortis-

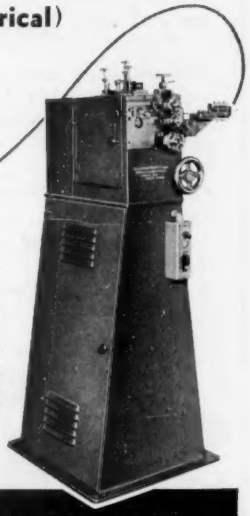
THE MOST COMPLETE LINE OF SPRING MAKING MACHINERY . . .

DESIGNED AND BUILT FOR THE METAL WORKING INDUSTRY

Sleeper & Hartley produce a complete line of spring-making machinery serving the basic metal working industries:

- Fabricated Metal Products
- Instruments
- Ordnance
- Furniture and Fixtures
- Transportation Equipment
- Electrical Machinery
- Machinery (except electrical)
- Miscellaneous Products

Quality and dependable service during 47 years of Sleeper & Hartley production have given the customer satisfaction for which we constantly strive.

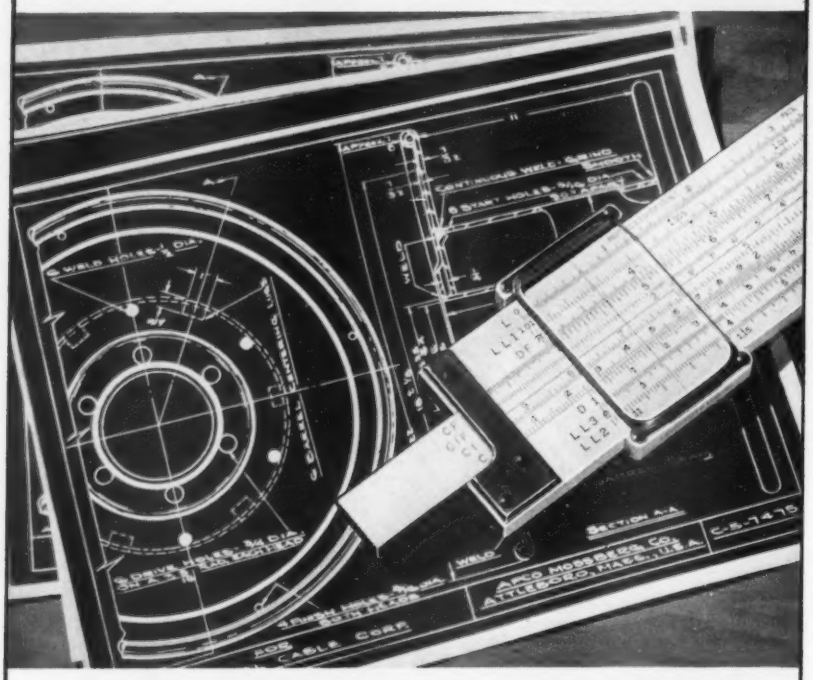


No. 0 UNIVERSAL SPRING COILER, ESCAPEMENT TYPE. Series 720 — 73" Model.
This newest, versatile machine in the exclusive S&H escapement line incorporates the most advanced design engineering in the field, to give greater wire feed range and high speed production. Its many features include extremely accurate wire feed and controls for fine precision adjustment. Inertia is minimized since the only thing that starts and stops with this type feed mechanism is the wire itself.

Write for latest information . . .

SLEEPER & HARTLEY, INC., BOX 1249, WORCESTER 1, MASS., U.S.A.

If you draw wire . . .



DRAW ON APCO MOSSBERG

for engineered reels, spools and bobbins

A wealth of experience — gained through more than 50 years of service to wire and wire rope manufacturers — makes Apco Mossberg well qualified to fill your complete requirements for steel reels, spools and bobbins.

The full-time staff of Apco Engineers, teamed with skilled craftsmen and modern production facilities, is ready at all times to bring you custom-made units in all sizes and designs. Their practical solutions to wire and wire rope handling problems often produce immediate and substantial production and shipping savings.

For preliminary recommendations, at no obligation, write, wire or phone Attleboro 1-0340 collect today.

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Canadian Representative:
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Toronto, Ontario, Canada

APCO MOSSBERG COMPANY
LAMB STREET, ATTLEBORO, MASSACHUSETTS

seur) winding, well insulated layer wound field coils, Class A or Class B insulation as specified.

★ ★ ★

Generators can be supplied for engine drive, either as two ball bearing units or single bearing with straight shaft or forged flanged shaft as required. A choice of special saturated direct connected or top mounted V-belt driven dripproof exciters is offered. Generators and exciters liberally comply with NEMA Standards MG-1 - 1955 and ASA-C50.

★ ★ ★

Columbia also manufactures DC Generators up through 300 KW, in addition to standard and low voltage motor generator sets.

New Miniature Teflon Multi-Conductor Cable

A new multi-conductor cable which saves as much as 56 per cent in overall diameter and as much as 36 percent in weight over conventional Teflon products, while standing up under the same dielectric tests, has been developed by **Inso Products, Ltd.** The new product, which offers miniaturization and reliability through the use of Inso's exclusive Fused-Film Teflon wire was announced by **Jerome I. Cohn,** general manager. It is now in production at the company's plant in Union, N. J.

★ ★ ★

A shielded twisted pair (No. 22 A W G) has 102 mil overall diameter as opposed to conventional Teflon multi-conductor cable with a 125 mil overall diameter. The cable is available in continuous unspliced, unbroken pinhole-free lengths up to 1,000 feet, permitting it to be cut to exact production requirements without waste, scrap or leftovers. Made in gages from #28 AWG through #18 AWG in standard constructions of 1, 2, 3, and 4 conductors with an overall shield and Teflon jacketing or any combination of Teflon and/or textile braids.

★ ★ ★

For information write Inso Products, Ltd., 404 Fifth Ave., New York 18, N. Y.

ABSTRACTS

These abstracts are published through the courtesy and with the permission of the Industrial Diamond Information Bureau, 2 Charterhouse Street, London , E.C.1, England. Inquiries regarding them should be directed to the Bureau.

MINIATURE PERMANENT MAGNETS
I. L. Cooter, R. E. Mundy (Nat Bur Standards) Instrument Pract 1958 Vol 12 (4) pp 358, 366 (Apr)

To obtain permanent miniature magnets, Cunife wire is first cold drawn to 0.020 in. through Carboloy dies, and further reduced to 0.005 in. through diamond dies.
A C 11.0

PREPARATION OF FINE WIRES FOR METALLOGRAPHIC EXAMINATION

G. L. Davis (Mullard Res Lab, Mitcham Junction, Surrey). Journ Sci Instr 1958 Vol 35 (4) p 149 (Apr)

A means of mounting fine wires for electrolytic polishing and etching for metallographic examination is described. Fine grinding and rough polishing was done by papers and diamond dust, and was completed electrolytically. 1 illustr.
F C 11.0 : C 12.61

THE MANUFACTURER OF DIAMOND DIES IN A MODERN SETTING
British Diamond Wire Co Ltd. Wire Ind 1958 Vol 25 (291) pp 261-264 (Mar)

The problems of dust proofing, temperature control elimination of vibration of the benches, and adequate lighting have all been dealt with in the new factory of the British Diamond Wire Co., which is described. 6 illustr. F C 11.0

A METHOD OF ELECTRICAL COMPARISON FOR THE DETERMINATION OF THE TEMPERATURE DISTRIBUTION IN DIE HOLES

Ein elektrisches Vergleichsverfahren zur Bestimmung der Temperaturverteilung in einem Ziehstein P. Funke jun. Stahl & Eisen 1958 Vol 78 (6) pp 380-382 (Mar 20) (In German)

A series of thermo-couples is inserted along the wire drawing die in such a way as to make good contact with the carbide surface of the die. By the potentiometer method, the difference in temperature between adjoining elements is measured directly, and the temperature distribution thus measured as function of the drawing speed, cooling conditions, etc. 4 illustr, 7 ref. H D 11.0

STRAIN-FREE DIAMOND DIE FIXTURE

Spannungsfreies Fassen von Diamant-Ziehsteinen Anon. Technica 1958 Vol 7 (7) p 321 (Mar 28) (In German)

A surface strain tester for diamonds, constructed by Dr. H. Schneider, Optotechnik, Bad Kreuznach, is described, and the use of polarization is recommended for examining diamonds for strain. 2 illustr. A D 11.0

Right down the line

BAIRD is your BEST BUY in 4-SLIDES

Built in the U.S.A. to machine-tool standards of **QUALITY.**

ALL PARTS for **ALL SIZES** always in stock.

Extremely ACCURATE

TOOLING INTERCHANGEABLE one machine to another of same size.

VERSATILITY limited only by ingenuity of tooling.

EASIEST to tool and adjust.

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9BA58

Outstanding Personalities of the Wire Industry

Pennsalt Chemicals Moves Pittsburgh Office

Pennsalt Chemicals Corporation's Industrial Chemicals Regional Office, formerly located in the Alcoa Building, Pittsburgh, moved into new quarters at Natrona, Pa., early in August. The move was to coordinate sales activities with plant facilities at the site of the company's original plant on the Allegheny River 21 miles north of Pittsburgh.

★ ★ ★

John C. Hampson, newly appointed Regional Manager, replacing **William P. Snelsire** who has retired, is in charge of sales activities for Pennsalt organic and inorganic chemicals.

★ ★ ★

Coincident with the relocation of the Industrial Chemicals Regional Office, Pennsalt announced that it will also move to Natrona the sales, research and development units of the Corrosion Engineering Products Department. The department's corrosion resistant products for the construction and industrial maintenance markets are currently manufactured at the Natrona plant.

★ ★ ★

Robert R. Pierce, recently named manager of the coordinated department in charge of sales, manufacturing and research and development; **James H. Cogshall,** recently appointed Corrosion Engineering Products Sales Manager; and **Robert S. Mercer,** new Manager of Development have also moved to Natrona.

Phelps Dodge V.P. Retires

Retirement of **Earle A. Mitchell,** a vice president of the **Phelps Dodge Copper Products Corporation,** has been announced. Mr. Mitchell was associated with the Habirshaw Division of Phelps Dodge for more than 39 years.

★ ★ ★

He joined the Habirshaw Wire & Cable Corporation on May 1, 1919 as an engineer, eventually being promoted to production manager and, in 1930, to works manager where he continued after the Habirshaw Wire & Cable Corporation was acquired by the Phelps Dodge Copper Products Corporation. On January 8th of this year he was elected vice president of the company.

Rome Cable Appoints Vice President

Allan M. Ziegler, General Manager **T. J. Cope Division Rome Cable Corporation,** has been made a Vice President of Rome Cable Corporation, according to an announcement by **A. D. R. Fraser,** President. Mr. Ziegler has been General Manager of Cope since 1955.

GLADER NAIL MACHINE

a **NAME** *and* **MACHINE**
that have stood for
DEPENDABILITY since 1887

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$ *our* **Nail Machine** $
$ **"KNOW-HOW"** $
$ *means* **$$$** *for you* $
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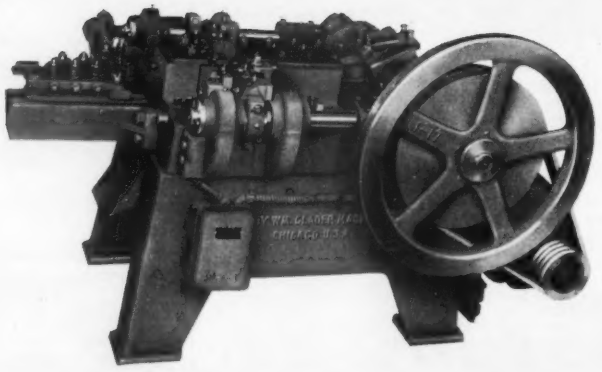


Wm. GLADER MACHINE WORKS 210 N. RACINE AVENUE CHICAGO 7, ILLINOIS

EXPORT DEPT. 122 EAST 42ND STREET • NEW YORK 17, N. Y.

Rome Cable purchased the assets of Cope in March, 1957, which is now operated as a Division. Their principal product is expanded metal wireway that serves to support cables in utilities and industry.

R B & W Names Plant Superintendent

Paul P. Polonec has been named plant superintendent at the Rock Falls, Ill., plant of **Russell, Burdsall & Ward Bolt and Nut Company,** according to an announcement by Lambert M. Kaspers, plant manager.

★ ★ ★

Mr. Polonec formerly was general foreman of the wire mill at the company's Port Chester, N. Y., plant. He has been associated with R B & W for more than 15 years.

★ ★ ★

A graduate of the Greenwich, Conn., school system, Mr. Polonec attended the Long Island School of Engineering and is a member of **The Wire Association** and the Masonic Order. He presently makes his home at 1003 Second Avenue, Sterling, Ill.

PAUL P. POLONEC

Moon Advanced by Signode

J. M. Moon was elected Executive Vice President of the **Signode Steel Strapping Company,** Chicago, Ill., by the Board of Directors at their meeting on July 24. In addition to assuming new responsibilities, Mr. Moon, who previously had been Vice President in Charge of Sales, will continue to direct the sales activities of Signode.

Wire Man Elected to Controllers Institute

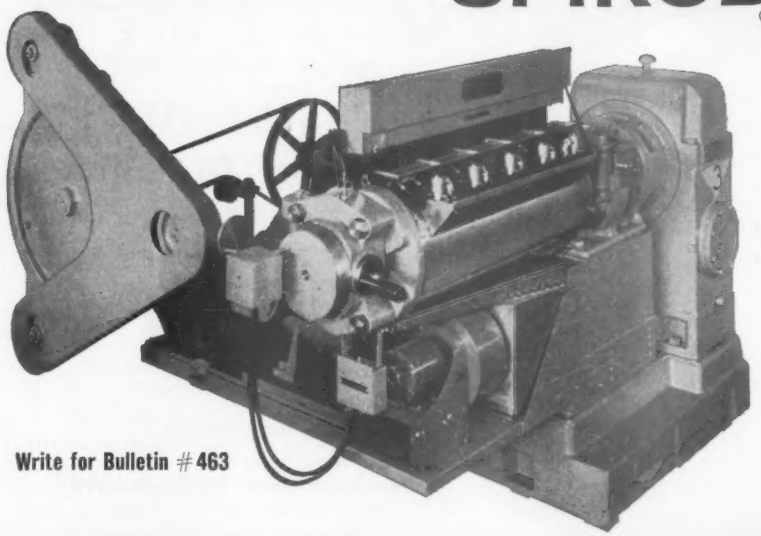
Alfred M. Raban, assistant treasurer, **The Seymour Manufacturing Company,** Seymour, Conn., has been elected to membership in the Controllers Institute of America.

★ ★ ★

Established in 1931, the Institute is a non-profit management organization of controllers and finance officers from all lines of business—banking, manufacturing, distribution, utilities, transportation, etc. The total membership exceeds 4,800.

ROYLE

SPIROD® for Rubber or Plastic Wire Insulating



Write for Bulletin #463

These all electric extruders with radiant heat and high velocity evaporative cooling are designed to process either plastic or rubber compounds. The result of more than three quarters of a century of experience — Royle pioneered the extrusion process in 1880— in the design and construction of extruding machines time tested features have been built into Spirod to assure dependability.

JOHN ROYLE & SONS

ROYLE PATERSON N. J. 1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

London, England — James Day (Machinery) Ltd. — Hyde Park 2430 - 0456

Home Office — V. M. Hovey J. W. VanRiper — SHerwood 2-8262

Akron, Ohio — J. C. Clinefelter Co. — BLackstone 3-9222

Downey, Cal. — H. M. Royal, Inc. — TOpaz 1-0371

Tokyo, Japan — Okura Trading Co., Ltd. — (56) 2130 - 2149

Agent for Canadian Nickel and Cobalt

Eldon L. Brown, President and Managing Director of Sherritt Gordon Mines Limited, Toronto, Canada, has announced that **Foote Mineral Company** of Philadelphia has been appointed its exclusive United States and Canadian sales agent for nickel and cobalt.

★ ★ ★

Sherritt Gordon is an important producer of metallic nickel and cobalt, operating mines and concentrating facilities at Lynn Lake, Manitoba, and a chemical metallurgical plant in Fort Saskatchewan, Alberta. In 1957 the firm produced 20,067,367 pounds of nickel and 172,053 pounds of cobalt.

★ ★ ★

Foote Mineral is the world's largest producer of electrolytic manganese metal, and processes a wide line of metallurgical ores and alloying materials. Both manganese and nickel are important metals in the manufacture of stainless steels, high temperature alloys and numerous alloys in the non-ferrous field.

Morgan Construction Appoints Sales Engineer

The Morgan Construction Company, Worcester, Mass., Engineers and Manufacturers of Rolling Mills, and allied steel equipment, have announced the appointment of **Warren H. Howard** as Sales Engineer. He has been assigned to the Pittsburgh office.

★ ★ ★

Mr. Howard comes to Morgan from the Rectifier Department of General Electric Company, where he was Manager of Industrial Sales. Previous positions with General Electric included Industrial Engineer in the Worcester area and in the Steel Mill Division in Schenectady, New York. He is a Mechanical Engineering graduate of M.I.T. and is a member of the Association of Iron and Steel Engineers, the American Institute of Electrical Engineers, and is a past chairman of the Worcester Chapter of the A.I.E.E.

Kaiser Aluminum Appointments

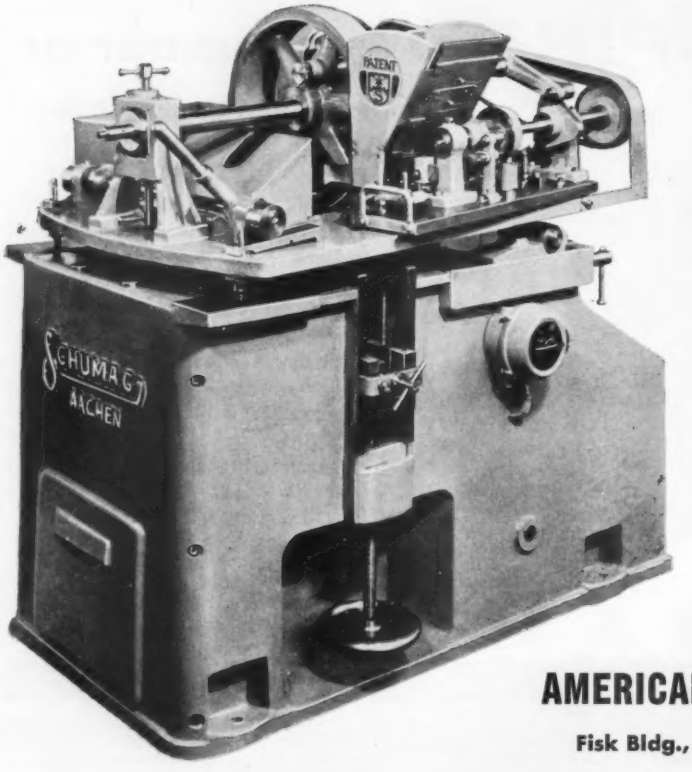
The appointments of **Gillette N. Houck** as manager of promotion and technical development and **J. Carl Ferguson** as general sales manager of the Electrical Conductor Division, **Kaiser Aluminum & Chemical Corporation,** are announced by **J. T. Dugall,** general manager of the division.

★ ★ ★

Another change in the division's general sales staff at Chicago involved **R. J. Harrison,** who has been promoted from assistant product manager to manager of utility sales with responsibility for coordinating sales to utility customers along with directing a key account program.

CF&I Appoints Traffic Manager

Gordon P. Smith has been elected director of traffic for **The Colorado Fuel and Iron Corporation,** it was announced in July by A. F. Franz, president. Prior to being named to his new post, Mr. Smith was general traffic manager of CF&I's



SCHUMAG
AACHEN

Automatic Pointing Machines

For Mass Production

Rates 6,000 - 70,000 pieces/hr.

These machines are designed for completely automatic, high volume pointing of needles and other small cylindrical parts. Length of points adjustable.

Five models:

Shaft lengths from 1½" to 18"
Diameters from .020" to .390"

Exclusive Representatives
for U.S.A., Canada and Mexico

AMERICAN LAUBSCHER CORPORATION

Fisk Bldg., 250 West 57th St., New York 19, N. Y.

Eastern Division. He will maintain offices at the company's plant in Claymont, Delaware.

★ ★ ★

Mr. Smith began his professional career in 1934 with **E. I. DuPont de Nemours and Company,** where he was employed in the general traffic department. From 1945 to 1947, he was traffic supervisor of the **Allied Chemical and Dye Corporation's** General Chemical Division.

★ ★ ★

In 1947, he joined the Worth Steel Company as assistant traffic manager. When the company was acquired by CF&I in 1951, its name was changed to the **Claymont Steel Corporation** and Mr. Smith was appointed general traffic manager.

To Handle Stainless Sales

William R. Milliken, a veteran of 19 years' experience in metallurgy and sales with **United States Steel Corporation,** has been appointed manager of stainless bar and wire sales by **Universal-Cyclops Steel Corporation,** Bridgeville, Pa.

★ ★ ★

Mr. Milliken previously served as assistant to the manager of alloy sales with U.S.S. He is a graduate of the University of Pittsburgh.

Dominion Steel Appoints Engineer

Appointment of **Thomas R. Jopling** as Commercial Products Engineer of the Steel Fabrication & Manufacturing Division, Dominion Steel and Coal Corporation, Limited, has been announced by **H. R. Smith,** Dosco Vice-President. Mr. Jopling was educated at Lower Canada College and McGill University, graduating in Mechanical engineering in 1930. He was formerly General Superintendent of Canadian Tube and Steel Division of Dosco which he joined in 1933.

★ ★ ★

Mr. Jopling is a member of **The Wire Association** and Iron and Steel Engineers. He is a native of Willoughby, Ohio.

Union Drawn Installs New Furnace

A new continuous-type six-zone prepared atmosphere furnace, capable of producing 1,000 tons of "carbon corrected" annealed steel per month, has been placed in operation at **Republic Steel's** Union Drawn Division at Massillon, Ohio.

★ ★ ★

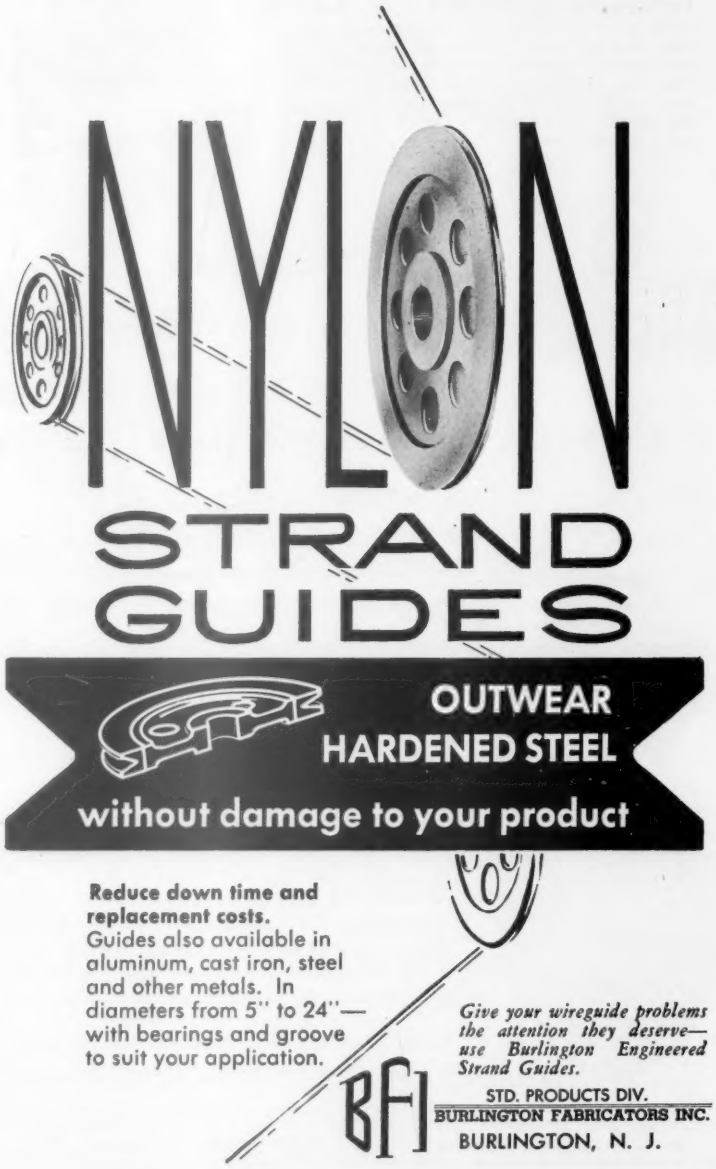
Made to specifications drawn by Union Drawn's chief metallurgist, **J. D. Armour,** the furnace is so designed that any type annealing cycle can be carried out. Each of its six zones can be maintained independently at the desired temperature. Also, steel bars and wire coils are conveyed through the furnace on rollers which can be varied in speed to permit whatever length of annealing cycle is required. This cycle can be fixed at from one to twenty-four hours. The furnace length is 60 feet.

You Are Invited To Join

THE WIRE ASSOCIATION

Send for booklet describing its activities and a membership application card.

453 Main St. Stamford, Conn.


NYLON
STRAND
GUIDES
OUTWEAR
HARDENED STEEL
without damage to your product
Reduce down time and replacement costs.
Guides also available in aluminum, cast iron, steel and other metals. In diameters from 5" to 24"—with bearings and groove to suit your application.
Give your wireguide problems the attention they deserve—use Burlington Engineered Strand Guides.
BFI
STD. PRODUCTS DIV.
BURLINGTON FABRICATORS INC.
BURLINGTON, N. J.

Extrusion Presses and Processing Machines

New Sutton Bulletin No. 50 presents representative examples of the company's varied line of extrusion presses and processing machines for all metals.

★ ★ ★

The illustrated two-color bulletin furnishes a guide to the selection of both hydraulic and mechanical equipment for extruding and finishing metal tubes, shapes and bars.

★ ★ ★

Extrusion presses from 750/900 ton to 1500/1870 to capacity. Pictured and described are both horizontal and vertical presses; hydraulic stretchers; detwisting machines; silent-running rotary swagers; centerless bar turners; 2-roll, 5-roll and 7-roll rotary straighteners; roller levellers and contour correcting machines.

★ ★ ★

Every machine is engineered to its application and special equipment is built to order. Copies are available from **Sutton Engineering Company,** First National Bank Building, Pittsburgh 22, Pa.

Reliance Introduces New Motor

A new weatherproof a-c. motor for use in "outdoor" type applications where the motor is subjected to extreme moisture or the elements is now available from **Reliance Electric and Engineering Company,** in all standard speeds in sizes from one through 250 horsepower.

★ ★ ★

Complete engineering specifications and prices may be obtained by writing Reliance at 24701 Euclid Ave., Cleveland 17, Ohio.

New Polyurethane Wire Enamels and Insulating Material

Based on specialty isocyanates developed and produced by its parent company, **The Carwin Company,** North Haven, Conn., these new enamels offer unique advantages to the user. In general, wire can be run at temperatures 150°F above that for conventional polyurethane enamels without sacrificing solderability yet permitting improved annealing of the copper. Enamels are now being commercially produced and sold to the industry for both dip and die coating.

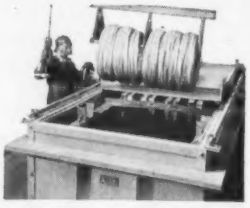
★ ★ ★

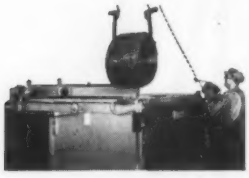
These products are the result of several years of intensive research and field trials. The Carwin Company is a completely integrated producer of isocyanates and polyurethane coatings, foams, and encapsulating resins having the distinct advantage of being able to tailor its raw materials to meet specific requirements in its end-product polymers.

Vertical All-Weather Motor

The Louis Allis Co. has introduced a new Weather Protected Vertical Motor intended for outdoor operation under all weather conditions including hurricane winds, driving rain, snow, sleet and wind-blown sand. The motor meets NEMA Type II Weather Protected specifications and is manufactured in ratings from 250 to 2000 HP, in both hollow shaft and solid shaft construction.

TYPICAL — The Ajax installation at right treats 1000 lbs. of aluminum alloy wire an hour. It is also used for annealing brass and copper wire and for stress relieving cold headed C1008 ½" steel rods. (Lower left) 700 lb. charges of steel wire are brought to annealing temperature in less than 15 minutes, clean, scale-free and without decarburization.





faster
more uniform
heat processing
AT LOWEST EQUIPMENT COST

Heating cycles are a matter of minutes . . . NOT hours. Bigger charges are handled far faster . . . in less floor space . . . in electric salt baths that cost about half the price of atmosphere furnace equipment of equal capacity. Molten salt seals out all air, preserves wire surfaces, guards against scale and decarb. Wire quality and uniformity are improved . . . because no other method matches Ajax Salt Baths for heating uniformity. Ideal for low- and high-carbon steels, stainless, aluminum, copper alloys and silver alloys.

AJAX
HULTGREN
electric SALT BATH furnaces

WRITE FOR case history bulletins on ☐ Process Annealing; ☐ Descaling; ☐ Patenting; or ☐ Cleaning, Preheating or Fluxing. These describe actual Ajax salt bath installations and actual wire processing results obtained.

AJAX ELECTRIC COMPANY
928 FRANKFORD AVENUE., PHILADELPHIA 23, PA.

Associates: Ajax Engineering Corporation • Ajax Electrothermic Corporation

Primary uses for the motor are in chemical and petroleum processing, irrigation,, municipal and other industrial applications in which vertical motors must operate without shelter or additional protection.

★ ★ ★

Bulletin No. 2600 presents full engineering information, including cutaway views of the motor's mechanical construction and airflow. Request a copy of the bulletin directly from The Louis Allis Co., Dept. P, Milwaukee 1, Wis.

Leschen Drawing Wire from Rod

The production of wire from steel rods has been added to the operations of **H. K. Porter Company's Leschen Wire Rope Division** at 2727 Hamilton Ave., St. Louis Mo., as part of their expansion program recently completed.

★ ★ ★

The company converted a 25 foot by 285 foot driveway into the industrial plant, constructed a 30 foot by 175 foot building at the rear, added a 25 foot by 146 foot mezzanine floor, renovated 12,500 square feet of existing plant and created a 12 foot by 25 foot die room and a metallurgical laboratory inside the mill structure, which together added 25,000 square feet of floor space.

Dynamometers with Maximum Pointers

Addition of a red maxium pointer as standard equipment to its entire line of traction dynamometers has been announced by **W. C. Dillon & Co., Inc.,** manufacturer of scientific testing instruments. At the same time, Dillon announced development of a new extra-heavy-duty model dynamometer, with a capacity of 0-150,000 pounds.

★ ★ ★

The maximum pointer eliminates the possibility of error, should the operator release a load before a reading has been made. The red maximum hand is automatically pushed forward by the main indicator, which is white. After tension is released, the white hand returns to zero, leaving the red maximum hand at peak point of load.

★ ★ ★

Addition of the new 0-150,000 pound model now brings the Dillon Dynamometer line to fourteen capacities, beginning at 0-500 pounds. Weight, tensile, torque or compression readings are certified for accuracy.

★ ★ ★

For detailed engineering data and prices, write W. C. Dillon & Co., Inc., 14620 Keswick St, Van Nuys, Calif.

Houghton Expands Steel Division

Announcement of an expanded Steel Mill Division for service and sales to steel product producers has been made by **E. F. Houghton & Co.**

★ ★ ★

This is a further step in a long range program initiated by **David J. Richards,** Vice-President - Sales. In addition to the coverage of the steel industry already provided by a field and technical force of over one hundred men, two specialists

HEAVY DUTY TAKE-UP
EST. 1855
AIMCO
INC. 1913
"American"
AIM INSULATING MACHINERY COMPANY
TRADE MARK
FAIRHILL AND HUNTINGDON STREETS
PHILADELPHIA 33 PENNSYLVANIA U.S.A.
*MANUFACTURERS OF WIRE INSULATING MACHINERY AND ALLIED EQUIPMENT. MACHINERY MFG. TO CUSTOMERS SPECIFICATIONS.
TAKE-UP
• Wire range .050" to .125".
• Speeds 500 to 1500 FPM.
• Multi-range constant tension winding drive.
• Automatic compensation for change in linear speed.
• Adjustable stalled and running tension and acceleration rate.
• Expansion type reel arbor; air ejection.
• Reels up to 30" diameter, 11" traverse, 1000 lbs. capacity.
AMERICAN INSULATING MACHINERY COMPANY
FAIRHILL AND HUNTINGDON STREETS
PHILADELPHIA 33, PENNSYLVANIA, U.S.A.

have been obtained to head up specific phases.

★ ★ ★

They are **Louis Schlossberg,** Manager of the newly formed Strip Mill Sales Division, and **William C. Johns,** Manager of the Bar, Tube and Wire Division. Both are highly qualified in their respective areas within the steel industry.

★ ★ ★

Houghton's products for steel mills include leather and rubber packings, lubricants, cutting oils, rust preventives, pickling inhibitors and hot top insulating compound.

★ ★ ★

Mr. Schlossberg and **Mr. Johns** will work out of the Main Office at 303 West Lehigh Ave., Phila. 33, Pa.

New Surface Grinder Announced

Norton Company announces a completely new Surface Grinder. The Norton 6 x 18" Type S-3 Hydraulic Surface Grinder's most significant feature is a substantial increase in table speed which reduces grinding time as much as 50% over similar machines. The maximum table traverse speed of 125' per minute is believed to be the fastest available on any surface grinder of this capacity.

★ ★ ★

In addition to reducing grinding time, the high maxium table traverse speed reduces burn, checking and cracking of the work. This is particularly true when grinding heat-sensitive steels.

★ ★ ★

Another exclusive feature is the machine's capacity for grinding a workpiece as high as 15" above the work table with a standard 8" diameter grinding wheel.

★ ★ ★

For a catalog giving complete details, write to Publicity Department, Norton Company, Worcester, Mass.

Energy Cartridges

Patented Flexi-Pak Energy Cartridges, in which pre-assembled stacks of belleville spring washers are held together by a flexible elastic covering, are now available from the Divisions of **Associated Spring Corporation,** Bristol, Conn. This new form of the Energy Cartridge is designed for applications where pins or rivets cannot be used to hold the washers together because the washer walls are too narrow, or where retaining rings or cores cannot be used because there is not sufficient vertical or radial clearance.

★ ★ ★

Two types of covering are being offered: a molded covering, which is cured around the washers while they are under a slight load, and a dipped or sprayed coating, which is applied to the stacks while they are held firmly together but relaxed.

★ ★ ★

Energy Cartridges provide com-

Coming to the Annual Convention of

THE WIRE ASSOCIATION at ATLANTIC CITY?

If you haven't made your hotel reservation—you'd better make it right away to be sure of a room at Convention Headquarters — The Chalfonte-Haddon Hall hotel.

Four feature-packed days—October 13-16—will make this Convention a high spot of the year for all men interested in matters concerning production. Note the program.

All wire men are cordially invited to attend. Members of the Association have been mailed their reservation cards. Non-members wishing to attend may secure them by writing to the address below. To-day is the day to make arrangements.

THE WIRE ASSOCIATION

RICHARD E. BROWN, *Executive Secretary*

453 MAIN STREET ○ **STAMFORD, CONN.**

pact spring components capable of exerting or absorbing high loads within limited space—that is, with small deflection.

New Extruder for Wire Announced

A new controlled pressure Extruder, capable of attaining pressures to 10,000 psi, has been introduced by **Johnson Machinery Co.** The pressures are developed by the installation of a control valve in the cylinder head.

★ ★ ★

According to a company spokesman, extrusion under controlled high pressures is capable of increasing the rate of production by at least 100% over present extrusion methods.

★ ★ ★

The J.M.C. Extruder is available in 1½", 2½", 3½" and 6" screw sizes, with a 21:1 L/D ratio. The screw is precision ground with hardened flights and cored for water cooling. Each screw is individually designed to meet the requirements of a particular operation. The extruder has a heavy duty spherical roller thrust bearing, and dual spherical roller bearings for radical loading, to withstand high pressures. The cylinder, which can be changed in one hour, is made from one piece heavy wall steel construction, with centrifugally cast Xaloy interior and is zoned for electric heating and air-cooling. The head, electrically heated with melt-temperature thermocouple control, is available hinged, loose-pieced, quick-opening clamped, or four-bolt fastened. The feed section is of cast steel construction and has an over-sized feed opening to prevent clogging of the feed section. The drive is available in a wide selection of variable or constant speed units, custom chosen to fit the operation. Enclosed herring-bone gears permit 50% overload capacity, and a flexible coupling connection protects the gear reduction unit from shock loading and compensates differences in thermal expansion between unit and thrust assembly.

★ ★ ★

All moving and heated parts are completely covered by heavily fabricated steel. Insulated covers shield the cylinder section. All electrical connections are brought down to a marked terminal bar for quick and easy hookup. The temperature controls, electrical controls, screw speed indicator and motor starting equipment are housed in a separate pyrometer control cabinet. All wires are brought out in a simple conduit for simplified hook-up. Induction heating is optional.

★ ★ ★

JMC are designers and builders of standard and special machinery for the Plastics, Rubber and Process Industries. Additional information is available from JMC, Dept. 167, 683 Frelinghuysen Ave., Newark, N. J.

Get the habit of reading regularly
WIRE AND WIRE PRODUCTS
The Wire Man's Magazine

Sole Representative: Paul Reicher Machinery & Equipment, P.O. Box 127, Willowdale, Ont., Canada

A Review of Recent Wire Patents

The data listed below is only a brief review of recent patents pertinent to the readers and subscribers of this publication.
Complete copies of these patents may be obtained by writing to the publisher of this magazine and remitting 50c for each copy desired. For orders received from outside the United States the cost will be $1.00 per copy.

No. 2,842,837, METHOD OF WORKING WIRE AND A LUBRICANT THEREFOR, patented July 15, 1958 by Raymond J. Huet, Chagrin Falls, and Gordon T. Spare, Chardon, Ohio, assignors to United States Steel Corporation, a corporation of New Jersey.

Wire is provided with a lubricant coating consisting essentially of a compound of the group having the formula $(CxH_2x+_1CONH)_2CH_2$ where x is any number from 7 to 17, and an inorganic nonvolatile lubricant of the class consisting of graphite, molybdenum disulfide, cadmium sulfide, cadmium iodide and boron nitride.

★ ★ ★

No. 2,843,159, SPRING FORMING APPARATUS, patented July 15, 1958 by Alfons A. Bonde, Oak Park, and Joseph S. Di Pasquale, Elmwood Park, Ill.

There are nine claims to this spring forming apparatus patent for coiling wire into a spring of predetermined diameter and length with long and short leg portions extending generally at right angles to axial planes, cutting off the spring from the wire supply and bending the leg portions, including the provisions of a hook at the end of the shorter leg portion.

★ ★ ★

No. 2,843,191, AUXILIARY FURNITURE SPRING, patented July 15, 1958 by William G. Regan, Shewsbury, Mass., assignor to Kay Manufacturing Corporation, Brooklyn, N. Y., a corporation of New York.

An auxiliary side spring adapted to be interposed between a sinuous main spring and a border wire in a spring structure for upholstered furniture is claimed. There are ten claims.

★ ★ ★

No. 2,843,260, WIRE COIL CONTAINER, patented July 15, 1958 by Murray M. Sommer, Crawfordsville, Ind., assignor to Mid-States Steel & Wire Co., Crawfordsville, Ind., a corporation of Indiana.

An open work core structure is provided and extending upward from the base of the container and formed of a pair of U-shaped loops which extend from the top of the container and exposed to be engaged by a lift for the container.

★ ★ ★

No. 2,843.878, APPARATUS FOR MANUFACTURING HELICAL WIRE, patented July 22, 1958 by Willi Berberich, Heilbronn (Neckar), Germany.

More specifically, the apparatus is for forming a helix from thermoplastic wire. There are seven claims.

★ ★ ★

No. 2,840,890, WIRE COATING, patented July 1, 1958 by Fred A. Emm, Towson, Md., assignor to Armco Steel Corporation, a corporation of Ohio.

Stainless steel wire is provided with a thin layer of cold-forming lubricant consisting essentially of about equal proportions by volume of common soap, lead and metal stearate selected from calcium stearate, aluminum stearate, lead stearate and zinc stearate.

★ ★ ★

No. 2,841,200, APPARATUS FOR SPREADING A COIL AND TWISTING THE SIDES THEREOF, patented July 1, 1958 by Robert B. James, Cincinnati, Ohio, assignor to James Equipment Co., Inc., Greenhills, Ohio, a corporation of Ohio.

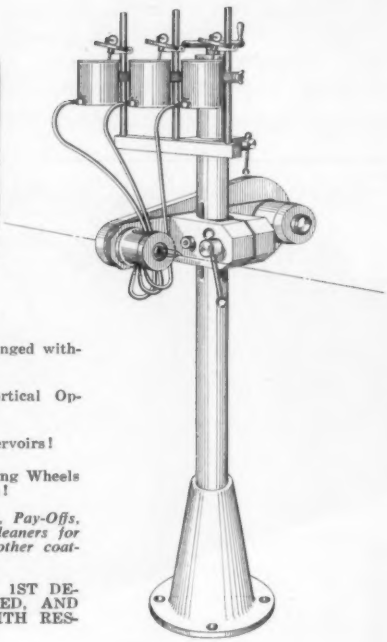
A coil forming apparatus is disclosed for use in spreading a wire coil so that the coil can fit into radially directed skewed slots arranged in angular spaced relation. There are 8 claims.

★ ★ ★

No. 2,841,201, WIRE COILING MACHINE WITH VIBRATING COILING DIE, patented July 1, 1958 by Wilfred R. Cheatle, Emporium, Pa., assignor to Sylvania Electric Products, Inc., a corporation of Massachusetts.

A COMPLETELY NEW APPROACH
CUTS STRIPING COSTS 50 TO 75%!
THE NEW

JLE
"JET-STREAM" SPIRAL STRIPING MACHINE*
CLASS JS



Now, perfect, high-speed spiral striping has been achieved in the fastest, most durable and versatile machine ever developed!

CHECK THESE FEATURES AND SEE FOR YOURSELF!

- Prints Complete Spirals in up to Three Colors, at Wire Speeds up to 500 F.P.M.!
- Continuous Ink Feeds eliminate shutdowns for refilling. Each filling LASTS AT LEAST FOUR HOURS!
- Stripe Widths and Pitch can be varied!
- Colors can be changed without shutdown!
- Horizontal or Vertical Operation!
- No Rotating Reservoirs!
- No delicate Printing Wheels nor Doctor Blades!

Optional accessories such as Drying Tubes, Take-Ups, Pay-Offs, etc., as well as a full line of Inks, Thinners and Cleaners for Rubber, Synthetic Rubbers, P.V.C., Polyetheline and other coatings are available.

MACHINES WILL BE READY FOR NOVEMBER 1ST DELIVERY. ORDERS ARE NOW BEING ACCEPTED, AND DELIVERIES SCHEDULED IN ACCORDANCE WITH RESERVATIONS.

Ask for Complete Data Today

James L. Entwistle Co.
SPARKING THE WIRE INDUSTRY SINCE 1918 JLE
100 GLEN ROAD, CRANSTON 10, R. I., U.S.A.
MAILING ADDRESS, P.O. BOX 3674
CABLE "JALENCO" PROVIDENCE - PHONE HOPKINS 7-8411

ENGLAND: *General Engineering Co. (Radcliffe) Ltd.*
Station Works - Bury Road
Radcliffe, Lancashire, England

* PATENT APPLIED FOR

A coiling machine, employing a spiral vibratory die is disclosed.

★ ★ ★

No. 2,841,300, METHOD OF AND MEANS FOR HANDLING COILS OF WIRE, patented July 1, 1958 by Leonard G. Berquist, Niles, Mich., assignor, by mesne assignments, to Clark Equipment Company, Buchanan, Mich., a corporation of Michigan.

A method of handling a group of wire coils, disposed side by side, with a lift truck having an upwardly and downwardly movable carriage provided with a ram is disclosed.

★ ★ ★

No. 2.841,633, ELECTRICAL CABLE STRUCTURE, patented July 1, 1958 by Frank M. Clark, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York.

A liquid dielectric filled electrical cable is disclosed comprising an electrical wire conductor, cellulosic insulation therefor comprising layers of paper impregnated with the liquid dielectric, at least one layer of the paper being adjacent the conductor, the insulation having therein resinous material and metal foil each completely surrounding the conductor.

★ ★ ★

No. 2.844,171, WIRE BENDING APPARATUS, patented July 22, 1958 by Samuel Kuba, Allentown, and Donald S. Magargee, Center Valley, Pa., assignors to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

The apparatus is adapted to provide a M-shaped form to the wire, There are ten claims.

★ ★ ★

No. 2,844.497, METHOD OF APPLYING SULFIDE COATING ON WIRES FOR DRAWING AND COMPOSITION THEREFOR, patented July 22, 1958 by John A. Hendricks, Logansport, Ind., assignor to Devex Corporation, Cleveland, Ohio, a corporation of Ohio.

A method of reducing the abrasive nature of the mill scale formed on steel at elevated temperatures is disclosed, comprising the steps of precoating the ferrous surface with a fusible alkaline film containing sulfur that will thermally react with iron to form a fusible ferrous film, and thereafter annealing the steel.

★ ★ ★

No. 2,845,200, WIRE FEEDING APPARATUS. patented July 29, 1958 by Lee E. Dilts Cleveland, and John H. Hollopetre, Mayfield Heights, Ohio, assignors to General Electric Company, a corporation of New York.

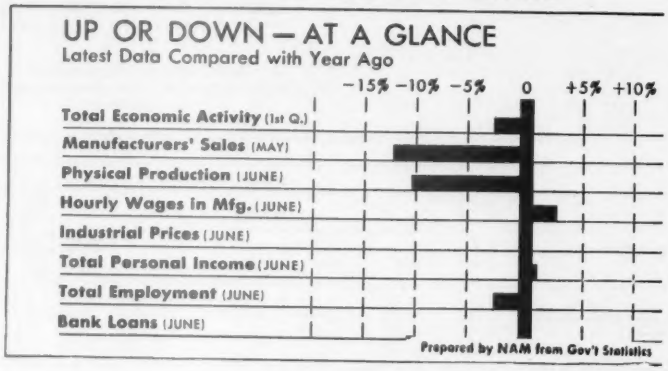
The novel feeding apparatus is for use with a carrier having a number of heads thereon and means for indexing the carrier to carry the heads intermittently to a number of stations, the feeding apparatus being disposed at one of the stations.

Get the habit of reading regularly

WIRE AND WIRE PRODUCTS

The Wire Man's Magazine

NEWS-FACTS ON ECONOMIC CONDITIONS–


UP OR DOWN — AT A GLANCE
Latest Data Compared with Year Ago
−15% −10% −5% 0 +5% +10%
Total Economic Activity (1st Q.)
Manufacturers' Sales (MAY)
Physical Production (JUNE)
Hourly Wages in Mfg. (JUNE)
Industrial Prices (JUNE)
Total Personal Income (JUNE)
Total Employment (JUNE)
Bank Loans (JUNE)
Prepared by NAM from Gov't Statistics

NILSON 4-SLIDES

FORMING PRODUCTION PROFITS... *Automatically*

COMBINE OPERATIONS on a NILSON

Wire and ribbon metal forms involving secondary operations can be produced at minimum cost on Nilson 4-Slides. You can combine stamping, welding, metal cutting and sub-assembly operations with the basic forming cycle . . . eliminate the need for expensive, single-purpose equipment.

The Nilson "Vertiform" shown above, for example, has a die head mounted on the right-hand forming slide. Wire stock is straightened, cut off, formed and threaded—all automatically in one cycle!

In addition to the new "Vertiform," Nilson builds 17 models of horizontal 4-slides, including 5 ribbon metal machines with built-in press units. For a new approach to low-cost production of wire forms and small metal stampings, it will pay you to get in touch with Nilson.

Send today for the Nilson General Catalog on Automatic 4-Slide Equipment!

NILSON

THE A. H. NILSON MACHINE CO.

1506 Bridgeport Avenue • Shelton, Conn.

AUTOMATIC WIRE & RIBBON METAL FORMING 4-SLIDE MACHINES • WIRE & STOCK REELS • WIRE STRAIGHTENING EQUIPMENT • AUTOMATIC STAPLE FORMING MACHINES • SPECIAL WIRE FORMING EQUIPMENT

AMERICAN IRON AND STEEL INSTITUTE
150 EAST FORTY-SECOND STREET, NEW YORK 17, N. Y.

AIS 10

JUNE - 1958
Month

SHIPMENTS OF STEEL PRODUCTS
ALL GRADES INCLUDING CARBON, ALLOY AND STAINLESS
(Net Tons)

Covering Net Shipments (Excluding Shipments to Members of the Industry for Conversion into Further Finished Products or for Resale)

Steel Products	Items	CURRENT MONTH 1958 Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1957) Percent of Total Shipments	YEAR TO DATE 1958 Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1957) Percent of Total Shipments
Ingots and Steel Castings	1A	10,586	6,910	1,844	19,340	0.3	0.5	69,433	60,364	11,453	141,250	0.5	0.6
Blooms, slabs, billets, sheet bars	1B	73,731	33,333	1,748	108,812	1.9	4.7	421,370	142,594	7,978	571,942	2.0	3.4
Tube rounds	1C	465	229	1	695	-	0.1	2,888	1,068	20	3,976	-	0.1
Skelp	2	10,620	-	-	10,620	0.2	0.1	* 47,911	-	-	* 47,911	0.2	0.2
Wire rods	3	90,635	843	608	92,086	1.6	1.3	406,435	5,664	2,820	414,919	1.4	1.2
Bars—Hot rolled (incl. light shapes)	14	437,118	101,063	3,683	541,864	9.4	9.5	* 2,068,866	* 499,960	16,833	* 2,585,659	9.0	9.8
Bars—Reinforcing	15	273,529	-	-	273,529	4.8	3.2	* 1,007,414	-	-	* 1,007,414	3.5	3.0
Bars—Cold finished	16	71,120	10,543	3,784	85,447	1.5	1.6	389,040	62,963	20,457	472,460	1.7	1.7
Tool steel	17	604	4,444	-	5,048	0.1	0.1	4,034	30,209	-	34,243	0.1	0.1
TOTAL BARS AND TOOL STEEL		782,371	116,050	7,467	905,888	15.8	14.4	* 3,469,354	* 593,132	37,290	* 4,099,776	14.3	14.6
Wire—Drawn	23	253,366	2,336	2,094	257,796	4.5	3.9	1,127,677	15,002	10,460	1,153,139	4.0	3.2
Wire—Nails & staples	24	54,059	-	1	54,060	1.0	0.8	224,992	-	8	225,000	0.8	0.6
Wire—Barbed & twisted	25	7,489	-	-	7,489	0.1	0.1	38,547	-	-	38,547	0.1	0.1
Wire—Woven wire fence	26	18,661	-	-	18,661	0.3	0.4	109,262	-	-	109,262	0.4	0.3
Wire—Bale ties & baling wire	27	16,359	-	-	16,359	0.3	0.1	42,072	-	-	42,072	0.2	0.1
Sheets—Hot rolled	31	549,763	22,037	2,609	574,409	10.0	9.8	2,640,707	* 107,099	13,522	* 2,761,328	9.6	9.9
Sheets—Cold rolled	32	838,077	2,489	11,401	851,967	14.8	13.5	4,358,101	16,235	52,712	4,427,048	15.4	13.9
Sheets—Galvanized	33	277,180	-	-	277,180	4.8	3.3	1,266,441	-	-	1,266,441	4.4	2.9
Sheets—All other coated	34	12,271	-	-	12,271	0.2	0.2	74,390	-	-	74,390	0.3	0.2
Electrical sheets & strip	35	2,828	38,649	-	41,477	0.7	0.8	17,653	205,338	-	222,991	0.8	0.8
Strip—Hot rolled	36	88,888	1,575	751	91,214	1.6	1.8	434,519	8,133	* 3,765	* 446,417	1.5	1.8
Strip—Cold rolled	37	67,456	2,606	13,857	83,919	1.5	1.4	* 374,232	12,226	64,801	* 451,259	1.6	1.4
TOTAL SHEETS AND STRIP		1,836,463	67,356	28,618	1,932,437	33.6	30.8	* 9,166,043	* 349,031	*134,800	* 9,649,874	33.6	30.9
TOTAL SHIPMENTS (1958)		5,405,709	294,037	46,471	5,746,217	100.0	xxx	*26,881,795	*1,589,464	*227,959	* 28,699,218	100.0	xxx
TOTAL - PRIOR YEAR (1957)		6,810,186	415,148	59,282	7,284,616	xxx	100.0	41,288,565	2,638,770	358,100	44,285,435	xxx	100.0

*Revised

73058

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ALUMINUM INGOT AND MILL PRODUCTS AND MAGNESIUM MILL PRODUCTS: MAY 1958

(Shipments and receipts are in thousands of pounds)

Item	Number of companies reporting shipments	May 1958			April 1958* net shipments	May 1957 net shipments
		Gross[1] shipments	Receipts[2]	Net[3] shipments		
ALUMINUM PIG AND INGOT, TOTAL	89	139,810	73,293	66,517	66,516	92,900
ALUMINUM MILL PRODUCTS, TOTAL	157	240,082	22,840	217,242	211,485	250,424
Sheet and plate, non-heat-treatable	30	100,369	18,567	81,802	81,355	89,914
Sheet and plate, heat-treatable	4	(D)	(D)	18,119	15,776	24,454
Foil, including foil in lamination	14	(D)	(D)	15,739	15,874	15,880
Rolled, and continuous cast, rod and bar[4]	5	8,098	3,288	4,810	6,077	13,587
Wire, bare, conductor and nonconductor	17	3,303	195	3,108	3,388	4,273
ACSR and aluminum cable, bare	11	(D)	(D)	16,043	15,706	15,239
Wire and cable, insulated or covered	14	(D)	(D)	3,401	3,084	3,794
Extruded shapes, soft alloys	97	55,306	694	54,612	50,893	59,448
Extruded shapes, hard alloys	7	3,835	...	3,835	3,660	5,917
Drawn tube, soft alloys	13	6,760	...	6,760	6,081	5,867
Drawn tube, hard alloys						
Welded tube, non-heat-treatable	7	2,111	...	2,111	2,822	3,131
Powder and paste						
Atomized and grained powder	3	525	...	525	600	813
Flaked powder	5	298	...	298	277	511
Paste	5	1,566	...	1,566	1,077	1,344
Forgings (including impact extrusions)	14	4,513	...	4,513	4,815	6,252
MAGNESIUM MILL PRODUCTS, TOTAL	10	(D)	(D)	1,443	1,479	2,230

*Revised.

D Withheld to avoid disclosing figures of individual companies. These figures are included, however, in the appropriate total.

[1]Gross shipments of mill products represent total shipments by producers to customers, including other producers, and shipments by producers to their own fabricating departments which manufacture products beyond the level of mill shapes. Ingot gross shipments include shipments by importers.

[2]For mill products, represents receipts from domestic producers only. In addition to receipts from domestic producers, 49,000 pounds of mill shapes were received through imports. For ingot, receipts from imports are included.

[3]For mill products, derived by subtracting the sum of producer's domestic receipts of each mill shape from the industry's gross shipments of that shape. Ingot data derived by subtracting all receipts from shipments reported.

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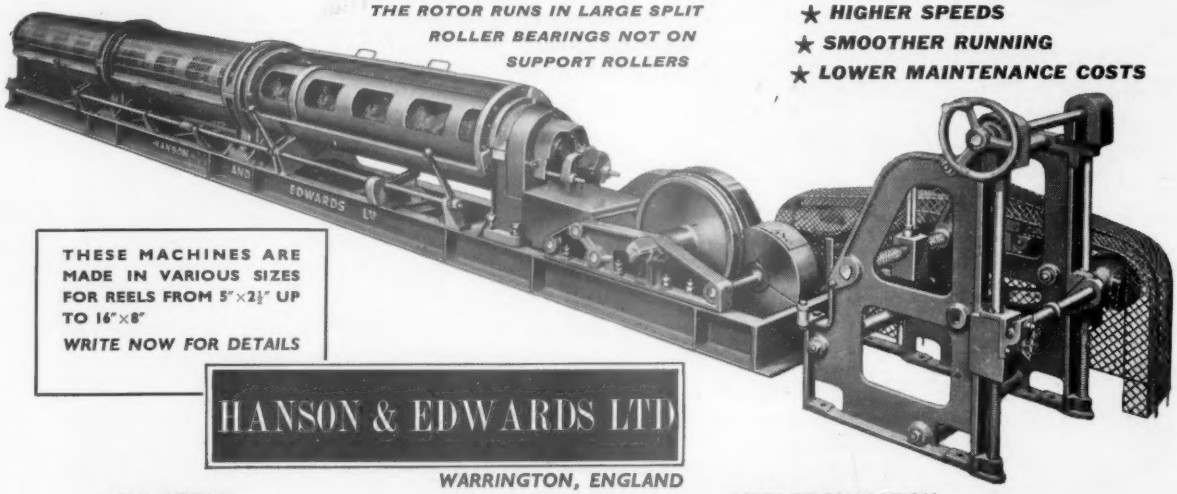

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P 1686

COPPER - Consumption of refined copper in the United States, April-May 1958, in short tons

	Wire mills 1/	Brass mills 2/	Chemical plants	Secondary copper smelters	Foundries and miscellaneous	Total
April:						
Cathodes	340	4,020	(3)	56	(3)	6,416
Wire bars	54,043	3,214	(3)	—	(3)	57,887
Ingots and ingot bars	545	3,860	(3)	214	(3)	4,619
Cakes and slabs	—	8,079	(3)	—	(3)	8,079
Billets	—	11,279	(3)	—	(3)	11,279
Other	66	—	(3)	16	(3)	82
Total	54,994	33,082	(4)	286	(4)	4/91,362
May:						
Cathodes	303	6,444	(3)	43	(3)	6,790
Wire bars	48,190	3,484	(3)	—	(3)	51,674
Ingots and ingot bars	686	3,192	(3)	172	(3)	4,050
Cakes and slabs	—	8,705	(3)	2	(3)	8,707
Billets	—	10,331	(3)	—	(3)	10,331
Other	91	—	(3)	26	(3)	117
Total	49,270	32,156	(4)	243	(4)	4/84,669

1/ Includes all wire mills with rod-rolling facilities. 2/ Includes all brass mills using copper in refinery shapes; some have rod-rolling facilities. 3/ Not available. 4/ Consumption by chemical plants, foundries, and miscellaneous plants not included. Estimate of 3,000 tons included in total.

INTRODUCING 100% PERFECTION IN WIRE TESTING WITH THE NEW

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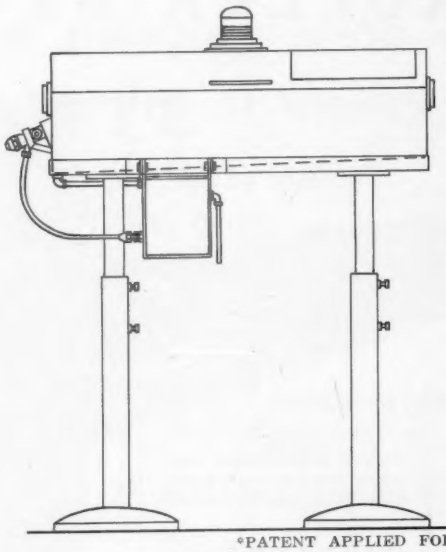
ELECTRODE UNIT*



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Aluminum for the Electrical Industries

(*Continued from page* 1015)

tons and copper expansion 458,000 tons.

★ ★ ★

The expansion pattern is pretty clear: In the aluminum industry, market development and capacity growth go hand in hand, each feeding on the other.

★ ★ ★

Closely related to market development and the expanding supply is aluminum's price record. A 1939-56 comparison shows:

	Prices		
	1939	1956	Increase
Aluminum	20 ¢	24 ¢	20%
Copper	11.2¢	46 ¢	311%
Lead	5.0¢	16 ¢	217%
Zinc	5.1¢	13.5¢	164%
Steel	1.5¢	3.4¢	125%

★ ★ ★

The price contrast becomes even more marked when aluminum and copper are compared on a performance basis. Since one pound of aluminum does the work of two pounds of copper, the prices of the two metals on a performance basis are:

Aluminum (1 lb.) electrical conductor pig	—24.5¢
Copper (2 lbs.)	92.0¢—

★ ★ ★

PRODUCTION (TONS) 1939-55

	1939	1955	1939-55 Increase Amount	Percent
Aluminum	164,000	1,566,000	1,402,000	857%
Copper	1,010,000	1,334,000	324,000	32%
Federal Reserve Board Index of Industrial Production	58	139	81	140%

★ ★ ★

Total supply, including imports and scrap, shows the following comparison:

SUPPLY (TONS) 1939-55

	1939	1955	1939-55 Increase Amount	Percent
Aluminum	223,000	2,134,000	1,911,000	857%
Copper	1,771,000	2,754,000	983,000	56%
Lead	733,000	1,250,000	517,000	71%
Zinc	728,000	1,459,000	731,000	100%

Aluminum price trends have been and are heavily influenced by market development considerations. To promote market development, aluminum prices have been more stable and increased relatively less than other major metals. Market development also

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#108

requires a steadily increasing supply and, in that connection, there was an increase in price some weeks ago to facilitate the financing of new capacity.

★ ★ ★

In summary, aluminum industry developments reflect a program of expanding supply and the maintenance of relatively low and steady prices. This has been possible because the aluminum industry has abundant ore supplies and adequate power resources. In addition, with so large a share of the total United States supply coming from the domestic industry, production and price policies can be pursued which most effectively promote market development and the further growth of the industry.

New Developments in Cable Jacketing Compounds

(*Continued from page* 1008)

nical advantages over conventional vinyl materials which make it ideally suited for use as Type IIa, non-migratory cable jackets. This discussion would not be complete without calling attention to some other applications in the wire and cable field for which these materials would be appropriate. The superior properties of internally plasticized vinyl materials are sure to be utilized in an increasing variety of applications.

★ ★ ★

During the preliminary investigation of this new material, a slight modification was found desirable for most applications other than the Type IIa jacket. Another material embodying this modification was formulated and designated NFD-5000. This compound is even tougher than NFD-3000 and is of considerable interest in the primary insulation field.

★ ★ ★

A promising field is in switchboard wire where few if any thermoplastic materials provide good service from both an electrical and physical point of view. The excellent strength characteristics of this new class of compounds provides the crush and splitting resistance required in many cabling and wire operations.

★ ★ ★

Another possible application might be in the B-Rural type of telephone cable consisting of six twisted pairs around a messenger. Each single has a black polyethylene primary and a colored vinyl jacket. The purpose of the vinyl is to provide circuit identification and abrasion resistance. The regular vinyl cannot be used alone because of the high electrical losses, nor can the polyethylene be used exclusively because of its lack of abrasion resistance and also the questionable weatherability of all but the carbon black-pigmented polyethylene compounds. Therefore, a costly double extrusion has been required on this type of construction. In contrast to this, it would seem feasible to formulate

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a tougher compound that weathers adequately in colors and exhibits excellent electrical properties (roughly equivalent to the polyethylene-vinyl combination) while involving only one coating.

★ ★ ★

Several other applications requiring toughness and abrasion resistance might include blasting wire, automotive wire, and some hook-up wires.

Studies in Electroless Plating

(*Continued from page* 1014)

The organic acids used for the buffering and complexing in the baths were found to have specific effects on the rate of deposition. Hydroxyacetic (glycolic) acid yielded a higher rate of deposition than most of the other acids, with the exception of lactic acid. However, the lactic acid bath was not as stable and produced rougher deposits. The rate of deposition reached a maximum at a specific concentration for each acid. Since the acids do not change the chemistry of the reaction, they may influence the rate through adsorption on the active nickel surface. Thus, the maximum in the rate curve can be explained on the basis that a low adsorption of the acid accelerates the reaction while a high adsorption poisons the catalytic surface.

★ ★ ★

Several hypotheses have been suggested to explain the electroless plating mechanism. The suggested theory involves a two-step process. In the first step, hypophosphite is catalytically decomposed to release hydrogen. In the second step, energy liberated in the discharge of hydrogen is transferred to the nickel ion, and activates the latter so that it can react with the hypophosphite ion. The nature and rate of hydrogen release determine the rate and efficiency of the nickel deposition. The hydrogen overvoltage on a metal surface may be taken as a measure of the ease of hydrogen liberation on the surface. A low

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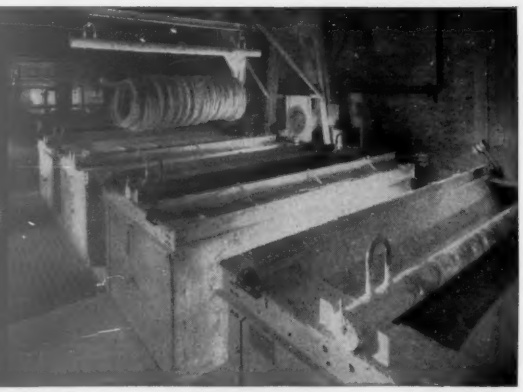

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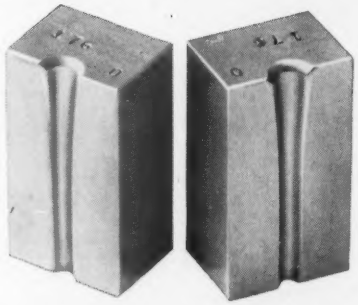

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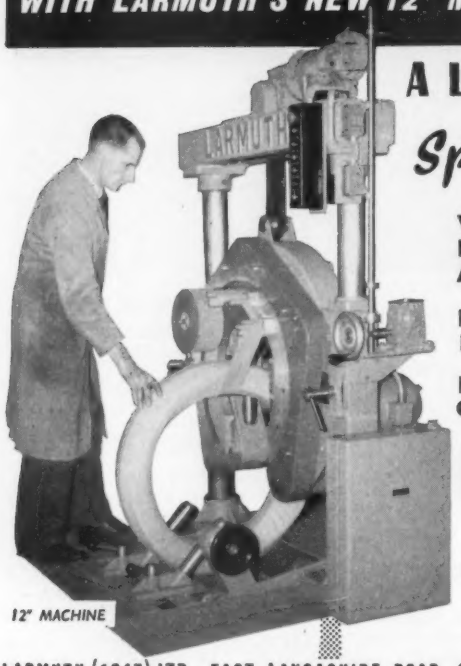

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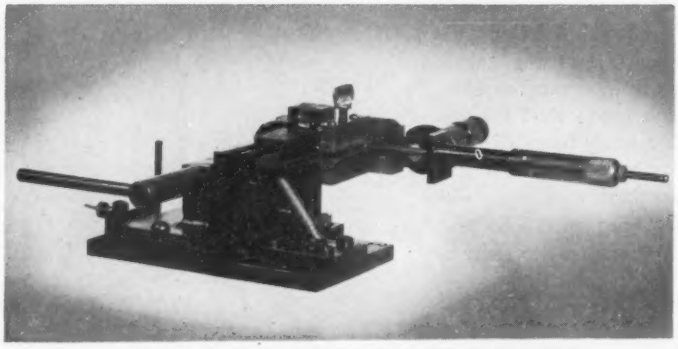

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overvoltage should facilitate the discharge; however, the energy for activating the nickel ion would also be low. The hydrogen should possess more energy for activation, if released from a high-overvoltage surface but its discharge would occur less readily. Consequently, some intermediate overvoltage should be the optimum for the deposition of nickel.

★ ★ ★

The suggestion that there should be a correlation between overvoltage and rate of plating led to a study of the influence of certain reagents on electroless plating. Although the correlation between overvoltage and the plating rate was not actually established, it was found that small concentrations of certain addition agents appreciably increased the rate, slightly higher concentrations decreased the rate while still higher concentrations prevented deposition. Certain substances, classified as catalytic poisons, in concentrations of about one part per million of solution markedly raised the rate of deposition. As with organic acids, the effect of these substances reached a maximum at a certain concentration. Thiourea and potassium thiocyanate gave the most significant effect. The former greatly increased the rate of deposition, producing a noticeable effect even in a concentration as small as 0.1 mg/1. As yet, it has not been determined whether these additives can be used in practical plating operations.

★ ★ ★

Outdoor exposure tests were made of plated steels to compare the protective value of electroless nickel deposits with that of electrodeposited nickel and nickel-phosphorus alloys. Samples were prepared from both acid and alkaline types of electroless baths. Results showed that electroless nickel coatings—from acid baths—offered steel greater protection against rusting than did electrodeposited coatings. Although somewhat tarnished, the electroless plates had only a few rust spots at the end of a 15-month period, while the electrodeposited nickel of the same thickness and under

the same conditions rusted considerably. The protective value of the electroless nickel deposits was equivalent to that of the electrodeposited phosphorus alloys which contained about 9 percent phosphorus.

[1] Electroless Plating on Metals by Chemical Reduction, NBS Tech. News Bul., 31, 111 (1957).
[2] Present address: Philips Research Laboratory, Kanstanje Laan, Eindhoven, Holland.
[3] For further technical information, see Studies on Electroless Nickel Plating, C. de Minjer and A. Brenner, Plating 44, 1297 (1957).

Costing—A Tool of Wire Mill Management

(*Continued from page* 1000)

the information obtained by costing is of no value unless it reaches those persons who can take action upon it; to the management it is vital that reports are received without delay, and of considerable assistance if they are properly presented.

★ ★ ★

Design of the form used is almost as important as the information contained; an arresting style of presentation can help focus attention on the vital figures, whilst an untidy report will be certainly wasteful of time and probably of enthusiasm. A report presented with comparable figures is often considered more favourably, and in the case of regular reports this takes little effort to provide and is well worthwhile doing. It is useful at times to check up on the use to which the reports are being put; frequently when such a check is made it is found that some are no longer required. The reason for this should be ascertained and where it is found that conditions have changed the report should cease or be brought into line with the changed conditions. In some instances, however, it is found that the form is badly designed, and a great deal of time is wasted in checking unnecessary detail: a redesigning of the form would help the recipient to establish the facts in much less time and the report would really be of service to him.

★ ★ ★

Repetitive reports which are required on a regular time cycle

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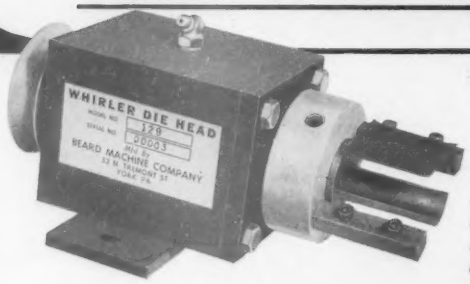

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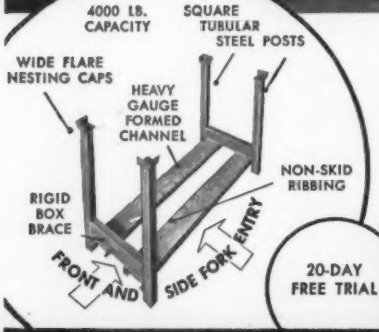

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MODULAR STORAGE SYSTEMS FOR METAL INDUSTRY • STEELMOBILE

should be presented at the specified intervals, every care being taken to ensure that they are not issued too late to be effective.

★ ★ ★

Throughout the functional range of costing the two most vital factors are accuracy and speed. On these two points, however, it is frequently necessary to arrive at a compromise. There are instances when urgency outweighs the need for absolute accuracy and where careful estimations may serve equally well, thus allowing necessary action to be taken sooner than would otherwise have been the case. It is also unwise to insist on that degree of accuracy which can only be achieved at great additional expense—too much detail, all carefully analyzed, can very easily cause a good deal of wasted time and money. Furthermore, the inclusion of too much detail in a report may prevent an accurate assessment of the problem and so instead of the costly analysis giving a clearer picture the opposite may be the case. Reports are most effective when clear and concise, and when no doubt can arise as to their true interpretation.

★ ★ ★

On the other hand the utmost caution must be exercised in order to ensure that the degree of accuracy which is required in any instance is not sacrificed in the cause of unnecessary speed.

Rome Cable Gets Patent on Cable Compound

Rudolph A. Schatzel, vice-president of engineering and research director of **Rome Cable Corporation,** Rome, N. Y., has been granted a United States patent for Roseal, a polyethylene butyl rubber resin used primarily as a sheathing compound on electrical wires and cables. The patent has been assigned to Rome Cable.

★ ★ ★

Chief advantages are high resistance to oils, chemicals, flames, and corrosive fumes; greater moisture resistance than other nonmetallic sheaths; easier pulling because of its waxy construction; trouble-free installation at temperatures as low as 55 degrees Centigrade and resistance to termite attack.

Quality Control "From Ore to Customer"

(*Continued from page* 1011)

in or draft disturb the heat pattern. Dust is an enemy and uniform temperature an ally.

Interesting History

The development of magnet wire has an interesting history and stretches over the past 40 odd years. Back when Canada Wire was a youngster in the wire and cable business, magnet wire was mostly just cotton wrapped copper wire. A major impetus to magnet wires came from radio in the early twenties. The sudden boom of colourful radio programs and the sale of radios, upped the demand for fine magnet wire. Radio manufacturers and the early electronics industry, began making demands for wires with better insulation qualities . . . wires with thinner insulation which would stand bending and abuse of all sorts. These demands forced manufacturers to investigate every conceivable material in an effort to offer better insulation. After World War II, the electronics and super-sonic aircraft industries added their demands for wire to operate at super-high temperatures.

* * *

From these technological advances over the years, electrical research laboratories gradually developed coverings for copper wires from almost every possible substance—liquid enamel, cotton, paper, silk, fibrous glass, vinyl acetate, asbestos and various plastics. Each wire coming off the Simcoe assembly-line has been developed to offer maximum insulation qualities for its special operating conditions. Some 54 different wire coating are applied at the plant.

If you're bragging about progress, just remember we've still got 18,215 blacksmith shops in the country, and less than half that many bookstores.

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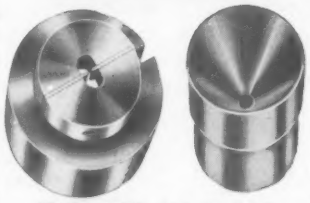

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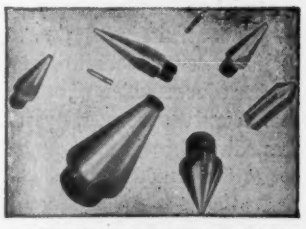

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BORAX 5 MOL offers worthwhile advantages over regular borax as a satisfactory coating material on ferrous rods and wire in preparation for dry drawing. This newer material offers a higher concentration of sodium borate and therefore savings may be realized through reduced transportation, handling, and storage costs. Only about three-fourths as much Borax 5 Mol need be used to equal regular borax . . . yet you get the same worthwhile results!

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Light Metal Wire Nails

(*Continued from page* 995)

nail again should become bright, it must be pickled. This consists of about a three minute immersion in a 15 to 20% caustic soda solution at 40° to 50°C, after which it must be rinsed with water and neutralized in dilute (10 to 15%) nitric acid, with a final thorough rinsing.

★ ★ ★

Materials of this kind that are most suitable for nail manufacture are the heat-hardened aluminums alloyed with manganese-silicon or with magnesium - silicon - manganese, and the cold-work-hardened alloy with copper-magnesium. With these the strengthening due to cold working is accompanied by an increase in recrystallization hardening, in contrast to cold-work-hardening, without a marked reduction in elongation. These materials are therefore more ductile.

★ ★ ★

All the above mentioned alloys can be equally well heat-hardened or cold-hardened, though respecting strength and elongation, AlMgSi has its most favorable range in the heat-hardened state, and, to the contrary, A1CuMg in the cold-hardened state. Of course the cold-hardened condition is the better for chemical resistance. A further advantage is that these materials can be finished in a quarter to a half hard wire.

Heat Hardened Nails

The difference between cold and heat-hardening lies merely in the fact that the latter can subsequently be annealed at 160°C.

★ ★ ★

The process of recrystallization hardening requires that the finished nails be annealed about one-half hour in a sodium-saltpeter salt bath between 500° and 510°C and then quenched in water at room temperature. The nails, however, will then not have the desired condition of hardness. They must continue to adsorb, and the highest value will be reached after about 5 days. Heat-hardened nails reach their highest strength

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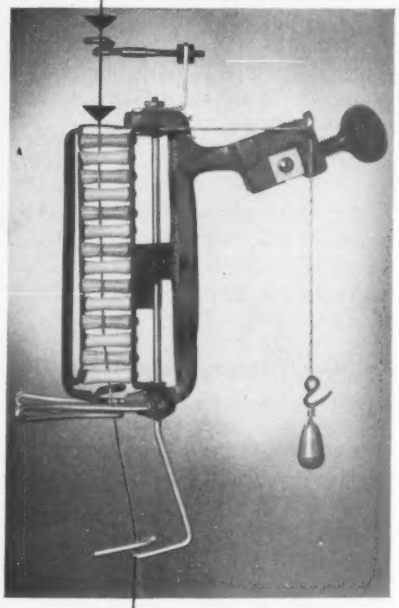

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after 12 hours. Naturally they can be packed and stored immediately. The quality factors are:

ALMgSi: 40,000 to 48,400 psi, with 9 to 16% elongation
AlCuMg: 50,000 to 64,000 psi, with 16 to 25% elongation

* * *

It is plainly seen that these alloys can be compared with St. 34 and St. 42. From this it follows that for the usual commercial article the naturally hard alloys will completely satisfy.

* * *

Experiments were made comparing nails of hardenable alloys in the heat treated state with steel nails in the strength range of 71,000 to 85,300 psi with elongation of 18%. These show differences in the ratio of 1:1½ on the average as measured by the nail lengths. For example, a steel nail 3.15 inches long with diameter 0.134 in. corresponds to one of aluminum 2.09 inches long of the same diameter. However, it can not be overlooked that with equal elongation on the average, the steel here mentioned is essentially stronger. More accurate comparative tests must be carried out with steels of the above mentioned group St.34 to 40.

* * *

In conclusion, in order that the reader may judge for himself the possibilities of wide application of aluminum nails, here are some of the substances to which they are immune:

Dry air and vapor, warm, cold or contaminated with flue gas or soot.
Sea-water and rain, (only for copper-free alloys).
Illuminating gas. Wet water vapor requires supplemental protective measures.
Sulphur and its oxide compounds, if they are dry.
Nitrogen, dry or wet.
Ammonia.
Carbon monoxide and dioxide.

* * *

A detailed list, in which all important corrosive substances and conditions for aluminum can be requested from the wire manufacturer.

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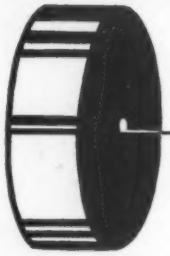
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Wire Stitcher Halves Assembly Cost of Cartons

A new OG wire stitcher automatically makes its own ICC-specification wire staples in the process of sealing carton-bottoms. A single 25 lb. spool of wire will furnish 8,000 1¼ crown staples for 2,000 bottoms, thereby reducing staple cost by at least 50%. Wire of varied sizes best suited to sealing large or small corrugated, solid fibre, light metal and other cartons may be used to assure maximum holding strength. There are no loose staples to jam, stick or slide over one another, as with cartridge clips or staples.

★ ★ ★

The OG wire stitcher is of sturdy pedestal construction with integral fractional hp motor and foot control starting-stopping. Engineered to give high speed, uninterrupted operation without maintenance or repair cost. Easily positioned at any point of assembly line.

★ ★ ★

Manufactured and guaranteed by **Pioneer Stitcher Div., Ordnance Gauge Co.**, Amber & Hagert Sts., Philadelphia 25, Pa.

New Catalog on Hydraulic Press Brakes

A new catalog No. 2024A describing the new line of Steelweld Hydraulic Press Brakes being currently introduced, is offered by **The Cleveland Crane & Engineering Co.**, Wickliffe, Ohio.

★ ★ ★

Because Steelweld Brakes are hydraulically operated, they provide a number of important advantages such as: positive overload protection; ram reversible at any point; stroke adjustment for any length; fast ram approach and return with slow-speed pressing; constant power during entire stroke.

★ ★ ★

Catalog No. 2024A gives construction details and specifications on machines.

Electrical Resistance Welding

(*Continued from page* 992)

given to make a flash weld and to help us to envisage what the machine should do.

A Typical Cycle of Operations to Make a Flash Weld

1. Straighten the ends of the wire for correct alignment in the dies.
2. Remove scale and polish ends to make good contact.
3. Position the ends in the gripper dies.
4. Power grip the wires (high pressures required up to 1½ times upset pressure).
5. Crop or cut ends to remove the roughness—chisel end will do for flash welding.
6. Switch on the current for pre-heat.
7. Contact the ends intermittently to get red heat.
8. Pre-heat current off and flash current on.
9. Flash off the ends to the required welding heat.
10. Forge (at a speed many times greater than (ix) and with a pressure of approximately 4 tons per sq. in.).
11. Release grips.
12. Position normalizing grips.
13. Normalize.
14. Remove the flash burr.

★ ★ ★

At the present time operation 1, 2, 3, 5 and 14 are carried out by hand; also in most cases in the wire trade operations 4, 5, 7, 8, 9, 10, 11 and 12 are dependent upon the attention and in some cases, the skill of the operator, yet if we are to strengthen the weak link in the automation chain of processes outlined earlier, a machine must be developed so that the only operation necessary to be done by hand is the position of the wire ends in the grippers (operation 3).

★ ★ ★

The welding machine envisaged will have to feed the lengths in through a straightening head, which could be a series of bell mouthed Tungsten Carbide bushes, staggered to straighten the wire ends, and a polishing machine and a cropping machine to remove any bad ends. With this must be the electrical system which need not be complicated.

★ ★ ★

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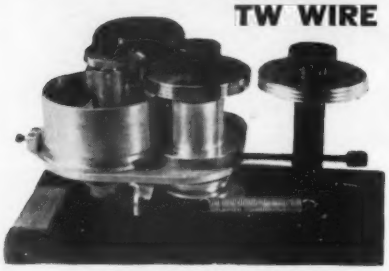

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There will, of course, be a need for a very simple hand-operated machine for fine wires, but we must move away from those ideas which have produced the conventional machine. For instance, it would be an advantage to have both platens moving for certain ancilliary operations, such as normalizing. The machine must ensure perfect alignment of the wires regardless of size. The present method, as we well know, is to provide the operator with a file and a hammer to do this operation.

★ ★ ★

One thing is certain; the machine which is going to do all that is detailed in the cycle of operations will be more of a mechanical problem than an electrical one, and there is no reason why one machine should not give us the choice of both methods. In some small way the conventional box-shaped welding machine containing simple electrical gear has influenced its design and has been considered as something complete in itself. The electrical system must be related to the welding machine as the electric motor is to any machine. We do find a place for the electrical motor which is most convenient. We may have to carry the welding transformer to the most convenient place to make a weld, quite possibly the only limitation being the length of the secondary leads.

★ ★ ★

Where we have a process which embodies a repetition of a number of operations each of which must be done precisely the same without any possible variation, we have the ideal state of affairs for automatic mechanization. If every operation necessary to make a sound weld is done according to that rule, then sound welds can be made and we shall be nearer the time when we can sell the welds to the customer.

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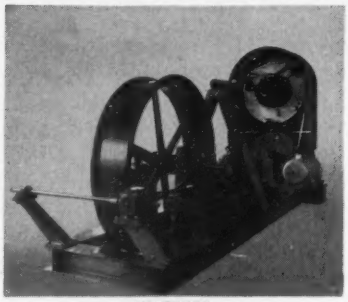

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* * *

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A free trial sample of Nolox G-707 may be obtained by writing Anchor Chemical Company, 10721 Briggs Road, Cleveland, Ohio.

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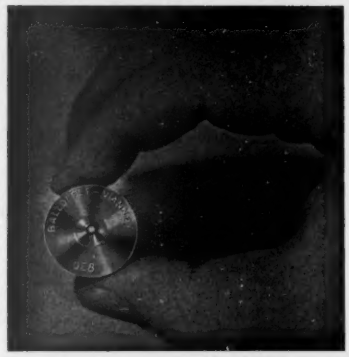

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The Drawing of Titanium (A55) and Titanium Alloy (C110M) Wire

(*Continued from page* 987)

and increases to the maximum value at the largest reduction of 50%. A reasonably clear trend is also found in Figure 6 for A55 lubricated with a less effective combination of graphite over a phosphate base. Consistent with greater frictional losses, the efficiency range is broader, the lowest levels being below those in Figure 5, and higher η values are more distinctly associated with larger α^*. With the stronger alloy C110M (Figure 7) the relationship of α^* to a frictional and redundant deformation losses is not easily picked out of the data so all that is offered is simply the trend of η rising with reduction. The efficiency levels are seen to be slightly below those in Figure 5, but again a value of $\alpha^* = 16°$ holds tolerably well over the reduction range considered.

General Remarks

The data presented above provide further insight into the mechanics of drawing titanium and titanium alloy wire. They are, of course, decidedly limited in the coverage that they provide of practical drawing conditions. In part, they suggest that some additional complication in the form of deformation heat would be introduced in experiments reproducing drawing at industrial speeds of 20 to 200 feet per minute, contrasted to the laboratory speeds of .02 to 20 inches per minute. Further, they tell nothing directly pertinent to the problem of die wear.

★ ★ ★

Nevertheless, several points of interest are brought out:

1. **the generally high deformation efficiency potentially available in the processing of such materials (up to 85%):**
2. **the high single-pass drawing limit, or drawability of about 50% for both A55 and C110M, comparable to the limits for many other more widely used materials;**
3. **the superior performance of lubricant films consisting of zinc stearate applied over a copper-plate base; and**

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4. the relative unimportance of die angle to efficiency, with $\alpha^* = 16°$ applying well under all conditions examined.

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AUTHOR'S NOTE

The statements and opinions expressed in this article are those of the author's and do not necessarily indicate the views or policy of the Army Ordnance Corps.

Machinable Carbide Arbors for Coil Spring Winding

The application of Ferro-Tic, the new machinable cemented carbide, to spring coiling arbors has been announced by the **Sintercast Corporation of America.** In preliminary tests, Ferro-Tic coiling and cut-off arbors for winding .218" Dia. carbon steel wire into valve springs showed a threefold increase in the average spring production over previously used tungsten carbide.

★ ★ ★

Butt welding of the Ferro-Tic to the steel arbor shank entirely eliminated the possibility of braze failure of ten encountered with tungsten carbide tipped arbors. Since Ferro-Tic is readily machined in the annealed state, required fabrication, i.e., sawing, turning, drilling, or aluminum oxide wheel

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GE Opens New Silicone Lab

A new laboratory offering unexcelled facilities for the development of new silicone products is now being occupied by the Silicone Products Department of the **General Electric Co.** Part of a continuing program of expansion, the new laboratory provides about double the space previously available for product development work.

★ ★ ★

Major items in the Operation Upturn program for G-E silicones are the completion and equipping of a new process development laboratory and conversion of the original product laboratory into a marketing technical center. These projects are expected to be completed during 1958-59, along with further expansion of production facilities.

★ ★ ★

Total costs for the current expansion of silicone facilities will exceed $5,000,000, reports **Dr. Charles E. Reed,** general manager of the department. This figure includes the purchase of an additional 69 acres of land acquired at Waterford two years ago. Most of this land has been earmarked for growth expected in the 1960's.

Pennsalt Appointments

James H. Cogshall has been appointed Sales Manager and **Robert S. Mercer** Manager of Development of the **Pennsalt Chemicals Corporation,** Corrosion Engineering Products Department. Both men will have their headquarters at Natrona, Pa.

National Wire Die Advances Two Men

The National Wire Die Co., Inc., 12 West 21st Street, New York 10, N.Y., manufacturers of diamond wire drawing dies, has announced the election of **Karl B. Gelfand** as President. He was formerly Vice President and has been with the company since 1936.

★ ★ ★

Succeeding Mr. Gelfand as Vice President, the company elected **Mac Rovin,** who had been Works Manager. He joined National in 1938. These changes were occasioned by the recent passing of the company's former president **Henry Harris.**

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Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Detroit

CUTTING TOOLS—Wire
Porter, H. K., Inc., Somerville, Mass.
Robinson, M. W. Co., Rockfall, Conn.

DIAMONDS—Industrial
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
Danforth, The C. W. Co., Youngstown, Ohio
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Research Company, St. Clair Shores, Mich.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDER RECLAIMING—
Danforth, The C. W. Co., Youngstown, Ohio
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Research Co., St. Clair Shores, Mich
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIAMOND TOOLS—
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Carbide, Tungsten & Tantalum
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Metallurgical Products Dept. of General Electric Co., Detroit
Rusch Wire Die Corp., Croton-on-Hudson, N. Y
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Cold Heading
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Detroit

DIES—Diamond
Ajax Industrial Supplies, Inc., Ft. Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.
Ft. Wayne Wire Die Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES DIAMOND—Drawing Angle Controlled
Hoosier Wire Die, Inc., Ft. Wayne, Ind.

DIES DIAMOND—Reversible
National Wire Die Co., Inc., New York, N. Y.

DIES—Extrusion
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Kelloy Corporation, New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Detroit
Rusch Wire Die Corp., Croton-on-Hudson, N. Y
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.
Wire Tool Div., Bridgeport Jig Boring Co., Bridgeport, Conn.

DIES—Eyelet
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass

DIES—Polishing, Asbestos Wire
Beard Machine Co., York, Pa.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Detroit
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Special Shapes, Etc.
Eastern Carbide Corp., New Rochelle, N. Y.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.

DIES—Swaging
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

DIES—Tube Drawing
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Hoosier Wire Die., Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Metallurgical Products Dept. of General Electric Co., Detroit
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRIVES—Electric, Adjustable Speed
Allis, The Louis Co., Milwaukee, Wisc.

DRUMS—Wire Packaging
Continental Can Company, Van Wert, Ohio
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

DRUMS & TRAVERSES—For Cable Reels
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio

DRYING EQUIPMENT—
Carl Mayer Corp., The, Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FOAM PRODUCING COMPOUNDS—
Amchem Products, Inc., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

FREQUENCY CHANGERS—
The Louis Allis Company, Milwaukee, Wisc.

FURNACES—Brazing
Ajax Electric Company, Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.

FURNACES—Galvanizing Equipment
Electric Furnace Co., Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
Ajax Electric Company, Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Pot (Oil, Gas, Electric)
Ajax Electric Company, Philadelphia, Pa.
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.

FURNACES—Resistance Heating, Strand
Electric Furnace Company, Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.

FURNACES—Salt Bath
Ajax Electric Company, Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio

FURNACES—Strand Annealing
Ajax Electric Company, Philadelphia, Pa.
Electric Furnace Company, Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.

GALVANIZING EQUIPMENT—(See MACHINERY—Galvanizing Wire)

GEARMOTORS—
The Louis Allis Company, Milwaukee, Wisc.

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

GUIDES—For Wire
Burlington Fabricators Inc., Products Div., Burlington, N. J.
Heany Industrial Ceramic Corp., New Haven, Conn.

GUIDE TIPS—For Extruding Machines (See NOZZLES)

HAMMERS—Nail Heading
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

INHIBITORS—Pickling
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INKS—Printing, for Insulated Wire
Chemical Products Corporation, East Providence, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.

INSULATING MATERIALS —
Apex Tire & Rubber Co., Pawtucket, R. I.
Blane Corporation, The, Canton, Mass.
Cary Chemicals, Inc., New Brunswick, N. J.
duPont de Nemours Co., (Inc.), E. I., Polychemical Dept., Wilmington, Delaware
General Electric Company, Insulating Materials Section, Schenectady, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Shawinigan Resins Corporation, Springfield, Mass.
Thompson Chemical Company, Pawtucket, R. I.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, New York, N. Y.

LACQUERING SYSTEMS—See MACH.—Lacquering Electric Wire

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LIME—
Warner Co., The, Philadelphia and Bellefonte, Pa.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corporation, Brooklyn, N.Y.
Miller, R. H., Co., Inc., Homer, N. Y.
Nopco Chemical Company, Harrison, N. J.
Standard Industrial Compounds Co., Frankfort, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire, Hose)
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Barbed Wire
Glader Wm., Machine Works, Chicago, Ill.

MACHINERY—Bobbin Winders
Hanson & Edwards, Ltd., Warrington, England
Larmuth and Bulmer, Limited, Manchester, England

MACHINERY—Bolt, Rivet, Screw, etc.
Behr Machinery & Equipment Corp., Rockford, Ill.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Braiding
New England Butt Co., Providence, R. I., Division of Wanskuck Co.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bunching
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Hanson & Edwards, Ltd., Warrington, England
Haskell-Dawes Machine Co., Philadelphia, Pa.
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bundling, Scrap
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Haskell-Dawes Machine Co., Philadelphia, Pa.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Capstans and Machinery—Winding Wire)

MACHINERY—Centerless Grinding & Polishing
American Laubscher Corporation, New York, N. Y.

MACHINERY—Chain Link Fence
Norton & Co., Ltd., Sir James Farmer, Manchester, England

MACHINERY—Chain Making
Baird Machine Company, Stratford, Conn.
Larmuth and Bulmer, Limited, Manchester, England
Nilson, A. H. Machine Co., Shelton, Conn.

MACHINERY—Closing Rope
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth and Bulmer, Limited, Manchester, England
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling Rod
Vaughn Mach'y Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Cold Heading
Behr Machinery & Equipment Corp., Rockford, Ill.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Copper Wire Drawing
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Herborn, Maschinenfabrik, Herborn, Germany
Morgardshammars Mek Verkstads A. B., Morgardshammar, Sweden.
National Mach'y Exch (Used), New York
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)

MACHINERY—Cutting
Eisler Engineering Company, Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn

MACHINERY—Dead Block (Stationary Coiler)
Morgan Construction Company, Worcester, Mass.
Wells Company, Frank L., Kenosha, Wisc.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Descaling Rod, Dry
Fisher Associates, New York, N. Y.
Herborn, Maschinenfabrik, Herborn, Germany
Wheelabrator Corporation, Mishawaka, Indiana

MACHINERY—Die Making
Boulin, Victor J., Inc., New York, N. Y.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Firth Sterling, Inc., Pittsburgh, Pa.
Metallurgical Products Dept. of General Electric Co., Detroit
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Edging (See MACHINERY — Tandem Rolling and Edging Mills)

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Davis Electric Co., Wallingford, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

MACHINERY—Extruding
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Royle, John, & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Norton & Co., Ltd., Sir James Farmer, Manchester, England

WHERE TO BUY, Continued

MACHINERY—Flat Wire
Mettler Machine Tool, Inc., New Haven, Conn.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Forming Wire
Baird Machine Company, Stratford, Conn.
Nilson, A. H. Machine Co., Shelton, Conn.

MACHINERY—Galvanizing Wire
Vaughn Machinery Co., Cuyahoga Falls, O.
Whitacre Engineering & Manufacturing Company, Alhambra, California
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Mfg. Co., Wallingford, Conn.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Hydraulic
Porter, Inc., H. K., Somerville, Mass.

MACHINERY—Insulating Wire
American Insulating Mach'y Co., Phila., Pa.
Beard Machine Co., York, Pa.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lacquering Electric Wire
American Insulating Mach'y Co., Philadelphia
Cook Mfg. Co., The, Paterson, N. J.
Michigan Oven Company, Detroit, Mich.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Wire & Cable
Davis Electric Co., Wallingford, Conn.
Entwistle, James L., Esmond, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
General Engineering Company (Radcliffe) Limited, Radcliffe, England
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N. Y.

MACHINERY—Packaging Wire
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Patenting Wire
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Plating
Hodge Bros. Machine Shop, Ossining, N. Y.
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Pointing
Herborn, Maschinenfabrik, Herborn, Germany
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Polishing Asbestos Wire
Beard Machine Co., York, Pa.

MACHINERY—Printing on Electric Wire
Entwistle, James L., Esmond, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.
Gillies, Duncan M. Co., Inc., Boylston, Mass.

MACHINERY—Re-Spooling
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Colbourne Machine Company, Winsted, Conn.
Emory Company, Robert J., Newark, N. J.
Entwistle, James L., Esmond, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Herborn, Maschinenfabrik, Herborn, Germany
Hodge Bros. Machine Shop, Ossining, N. Y.
Industrial Winding Machinery Co., New York, N. Y.
National Mach'y Exch. (Used), New York N. Y.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

MACHINERY—Rod Mill
Herborn, Maschinenfabrik, Herborn, Germany
Morgan Construction Co., Worcester, Mass.

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Rubber Insulating
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Royle, John & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Serving
Pourtier Pere et Fils, Romainville (Seine), France
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Spark Testing
Davis Electric Co., Wallingford, Conn.
Entwistle, James L., Esmond, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Staple
Baird Machine Company, Stratford, Conn.
Nilson, A. H. Machine Co., Shelton, Conn.

MACHINERY—Straightening & Cutting
American Laubscher Corporation, New York 19, N. Y.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Porter, Inc., H. K., Somerville, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Stranding
Hanson & Edwards, Ltd., Warrington, England
Haskell-Dawes Machine Co., Philadelphia, Pa.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth & Bulmer Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Düsseldorf-Rath, Germany
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Take-Up and Pay-Out
American Insulating Mach'y Co., Phila., Pa.
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Colbourne Machine Company, Winsted, Conn.
Collins Bros. Machine Co., Wire & Cable Machy. Div., Pawtucket, R. I.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Entwistle, James L., Esmond, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
General Engineering Company (Radcliffe) Limited, Radcliffe, England
Kraft, J. A., Maschinenfabrik, OLPE/Westf. Germany
Larmuth & Bulmer Limited, Manchester, England
Litzler, C. A., Co., Inc., Cleveland, Ohio
Northern Indiana Steel Supply Co., Inc., Michigan City, Indiana
Pourtier Pere et Fils, Romainville (Seine) France
Standard Mill Supply Co., Pawtucket, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Collins Bros. Machine Co., Wire & Cable Machy. Div., Pawtucket, R. I.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Testing Magnet Wire Coatings for Pin Holes
Federal Mfg. Co., Wallingford, Conn.

MACHINERY—Testing, Physical
Scott Testers, Inc., Providence, R. I.

MACHINERY—Thread Rolling
Mettler Machine Tool, Inc., New Haven, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Universal Industrial Equipment Co., Secaucus, N. J.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill, Cold Drawing
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.

MACHINERY—Welded Wire Mesh
National Electric Welding Machines Co., Bay City, Michigan
Schlatter, Ltd., H. A., Zollikon/Zurich

MACHINERY—for Wire Welding
(See WELDERS—Butt and Spot and Machinery—Welding Wire Fabrics)

MACHINERY—Winding Wire
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Entwistle, James L., Esmond, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Laubscher Corporation, New York 19, N. Y.
Cook Manufacturing Co., The, Paterson, N. J.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Federal Mfg. Co., Wallingford, Conn.
Herborn, Maschinenfabrik, Herborn, Germany
Hodge Bros. Machine Shop, Ossining, N. Y.
Morgan Construction Co., Worcester, Mass.
Morgardshammars Mek Verkstads AB, Morgardshammar, Sweden
National Mach'y Exch. (Used), New York, N. Y.
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wartenweiler, Emilio, Milan, Italy
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Wire Forming
Baird Machine Company, Stratford, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Nilson, A. H. Machine Co., Shelton, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Wire Rope
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
Larmuth (1947) Ltd., Swinton, England

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MOTORS—Electric, A.C. — D.C.
The Louis Allis Company, Milwaukee, Wisc.

NAIL TOOLING—Tungsten Carbide
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
Wickwire Brothers, Inc., Cortland, N. Y.

NIPPERS—Wire Cutting
Robinson, M. W. Co., Rockfall, Conn.

NOZZLES—For Extruding Machines
Wire Tool Div., Bridgeport Jig Boring Co., Bridgeport, Conn.

OVENS—Cable Lacquering and Enameling
American Insulating Mach'y Co., Phila., Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Colbourne Machine Company, Winsted, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

OVENS—Rod Bakers
Carl Mayer Corp., The, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl Mayer Corp., The, Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio

PAILS—Packaging
(See Drums—Wire Packaging)

PAINT BONDING CHEMICALS—
Amchem Products, Inc., Ambler, Pa.

PAINTS—Heat Resisting
Amchem Products, Inc., Ambler, Pa.

PAPER—Creped Wrapping
Ludlow Papers, Inc., Needham Heights, Mass.

PAPER—For Coil Wrapping and Corrosion Prevention
Ludlow Papers, Inc., Needham Heights, Mass.

PAPER—Insulating
Ludlow Papers, Inc., Needham Heights, Mass.
Twitchell, Inc., E. W., Philadelphia, Pa.

PATENT—ATTORNEYS—
Rommel, Allwine & Rommel, Washington, D. C.

PAY-OUT SYSTEMS—
(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS
(See COMPOUNDS—Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PLASTICIZERS—
Cary Chemicals, Inc., New Brunswick, N. J.
Monsanto Chemical Company, Plastics Division, St. Louis, Mo.

PLASTICS—for Wire Insulation
Apex Tire & Rubber Co., Pawtucket, R. I.
Blane Corporation, The, Canton, Mass.
Cary Chemicals, Inc., New Brunswick, N. J.
duPont de Nemours Co., (Inc.), E. I., Polychemical Dept., Wilmington, Delaware
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Shawinigan Resins Corporation, Springfield, Mass.
Thompson Chemical Company, Pawtucket, R. I.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, New York, N. Y.

PRINTING WHEELS—for Electric Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Co., Inc., West Hanover, Mass.
Gillies, Duncan M. Co. Inc., Boylston, Mass.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

RACKS—Wire Storage
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Jarke Manufacturing Co., Chicago, Illinois

REEL AND TENSION STANDS—
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Mettler Machine Tool, Inc., New Haven, Conn.
Northern Indiana Steel Supply Co., Inc., Michigan City, Indiana
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
National Vulcanized Fibre Co., Lestershire Spool Div., Johnson City, N. Y.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio

REELS—Metal Bound
Durkee Mfg. Co., Inc., Pine River, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
National Vulcanized Fibre Co., Lestershire Spool Div., Johnson City, N. Y.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REELS—Plywood
Carris Reels, Inc., Rutland, Vt.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Evans, George, Corp., Moline, Ill.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
National Vulcanized Fibre Co., Lestershire Spool Div., Johnson City, N. Y.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS—Steel, for Rope and Cable
Evans, George, Corp., Moline, Ill.

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Boonton Molding Company, Boonton, N. J.
Bridge Mfg. Co., The, Hazardville, Conn.
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Molded Fiber Glass Tray Co., Linesville, Pa.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
National Vulcanized Fibre Co., Lestershire Spool Div., Johnson City, N. Y.
Nilson, A. H. Machine Co., Shelton, Conn.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Wood
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—
(See OVENS—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Pittsburgh Steel Co., Pittsburgh, Pa.

RODS—Wire—Non-Ferrous
Aluminum Company of America, Pittsburgh, Pa.
Platt Bros. & Co., The, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.

RODS—Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Niederrheinische Huette, A. G., Duisburg, Germany
Pittsburgh Steel Co., Pittsburgh, Pa.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.

RUST PROOF COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

RUST REMOVING COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

SATURATION SYSTEMS—
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

SOAPS—Industrial and Wire Drawing
(See COMPOUNDS—Wire Drawing)

SPOOLS—Plastic
Boonton Molding Company, Boonton, N. J.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Molded Fiber Glass Tray Co., Linesville, Pa.
National Vulcanized Fibre Co., Lestershire Spool Div., Johnson City, N. Y.
Standard Mill Supply Co., Pawtucket, R. I.

STAMPINGS—Steel
Acrometal Products, Inc., Minneapolis, Minn.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

STOCK STORAGE SYSTEMS
Jarke Manufacturing Co., Chicago, Illinois

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

TABLES—Press Feeding

TANKS—Ceramic, for Galvanizing
Ofenbau Fritz G.m.b.H., Hagen i.W., W. Germany.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TESTERS—INSULATION
(See MACHINERY—Spark Testers)

TESTING EQUIPMENT
(See MACHINERY Testing, Physical and Diameter Testing)

TINSEL—Electric Conductor
Montgomery Co., The, Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper Silver and False Gold Coated, etc.
(See TINSEL—Electric Conductor)

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.

TOOLS—Wire Cutting
Porter, H. K., Inc., Somerville, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

TRANSMISSIONS—Variable speed (See Adjustable Speed Drives)

TRAVERSES & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Hodge Bros. Machine Shop, Ossining, N. Y.
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

VARNISHES & LACQUERS—for Electric Wire
General Electric Company, Insulating Materials Section, Schenectady, N. Y.
Shawinigan Resins Corporation, Springfield, Mass.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila, Pa.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

WAXES—for Insulated Wire
Cary Chemicals, Inc., New Brunswick, N. J.

WELDERS—Spot and Butt and Welding Wire Fabrics
Eisler Engineering Corp., Newark, N. J.
Micro Products Co., Chicago, Ill.
National Electric Welding Machines Co., Bay City, Michigan
H. A. Schlatter, Ltd., Zollikon-Zurich

WHEELS—for Printing on Electric Wire
Gem Gravure Company, West Hanover, Mass.
Gillies, Duncan M., Co. Inc., Boylston, Mass.

WIRE—Aluminum
Aluminum Company of America, Pittsburgh, Pa.
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Ball
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Barbed
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

WIRE—Brass and Bronze
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Cadmium
Stamford Processing Co., Peekskill, N. Y.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Clad and Plated
Sylvania Electric Products Inc., Warren, Pennsylvania

WIRE—Cold Heading
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Scovill Mfg. Co., Waterbury, Conn.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Copper
Sylvania Electric Products Inc., Warren, Pennsylvania
United Wire & Supply Corporation, Providence, R. I.

WIRE—For Electrical Conductors
Aluminum Company of America, Pittsburgh, Pa.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Flat
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
Montgomery Co., The, Windsor Locks, Conn.
National Standard Company, Niles, Mich.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Sylvania Electric Products Inc., Warren, Pennsylvania
United Wire & Supply Corporation, Providence, R. I.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Galvanized
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
National Standard Company, Niles, Mich.
Roebling's, John A. Sons Corp., Trenton, N. J.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—High Carbon
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Manufacturers
Aluminum Company of America, Pittsburgh, Pa.
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Lock Washer Company, The, Newark N. J.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corporation, Pressed Steel Div., Cleveland, Ohio
Roebling's, John A., Sons Corp., Trenton, N. J.
Scovill Mfg. Co., Waterbury, Conn.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
Sylvania Electric Products Inc., Warren, Pennsylvania
United Wire & Supply Corporation, Providence, R. I.
U. S. Steel Corp., N. Y., N. Y.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Metalizing
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WIRE—Music
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Worcester Wire Works Div., National-Standard Company, Worcester, Mass.

WIRE—Needle
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Alloy
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Malin & Co., The, Cleveland, Ohio
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Oil Tempered
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Special Shapes
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
Continental Steel Corp., Kokomo, Ind.
National Lock Washer Company, The, Newark, N. J.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Sylvania Electric Products Inc., Warren, Pennsylvania
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Spring
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Roebling's, John A., Sons Corp., Trenton, N. J
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
United Wire & Supply Corporation, Providence, R. I.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Firth Sterling, Inc., Pittsburgh, Pa.
National Lock Washer Company, The, Newark, N. J.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Steel—Also Coppered and Galvanized Steel
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Roebling's, John A., Sons Corp., Trenton, N. J
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Brothers, Inc., Cortland, N. Y
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WOOD—for Guide, Rolls, Bushings, Wear Parts, etc.

WRAPPING PAPER—Creped
(See PAPER—Creped Wrapping)

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE
AND MASTICATING MACHINERY MANUFACTURERS

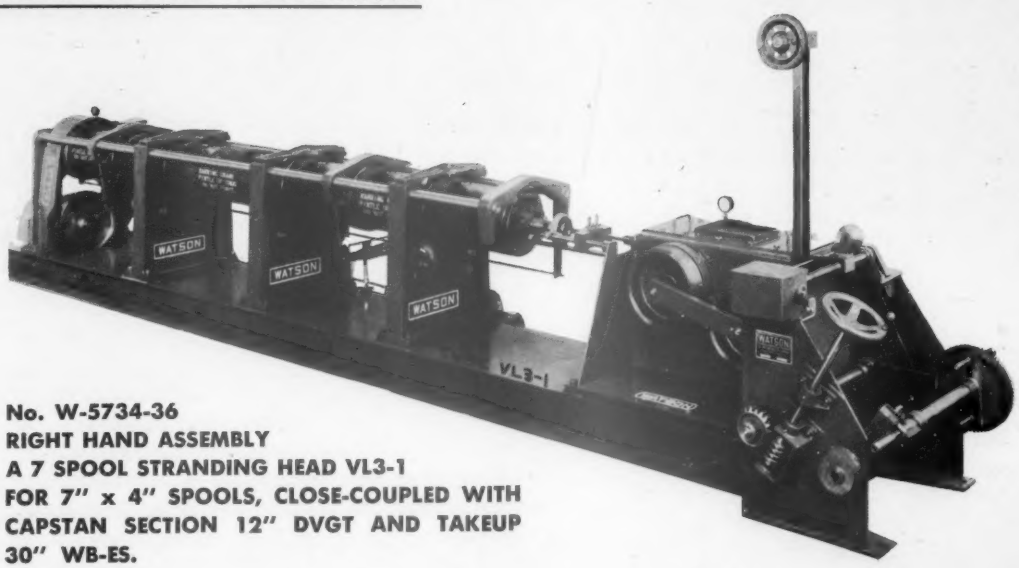
WATSON

EXTRA HIGH SPEED STRANDERS TYPE "VL"

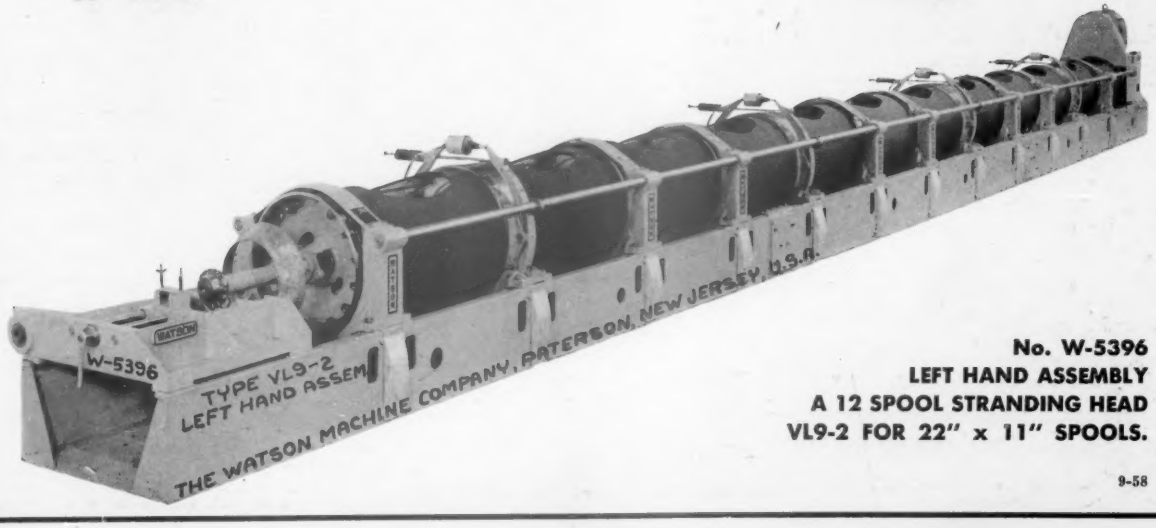
U. S. Patents 2,442,817 & 2,690,642

THESE MACHINES ARE BREAKING PREVIOUS PRODUCTION RECORDS AND THEIR QUIET, "HIGH SPEED WITH SAFETY" PERFORMANCE HAS SET NEW STANDARDS WHEREVER THEY OPERATE.

AVAILABLE IN MANY SIZES FOR SPOOLS FROM 3-3/4" DIAMETER (5 POUND) TO 24" DIAMETER (1,000 POUND), THE LATTER PARTICULARLY EFFICIENT IN "PRESTRESSED CONCRETE STRAND" PRODUCTION.



No. W-5734-36
RIGHT HAND ASSEMBLY
A 7 SPOOL STRANDING HEAD VL3-1
FOR 7" x 4" SPOOLS, CLOSE-COUPLED WITH CAPSTAN SECTION 12" DVGT AND TAKEUP 30" WB-ES.



No. W-5396
LEFT HAND ASSEMBLY
A 12 SPOOL STRANDING HEAD VL9-2 FOR 22" x 11" SPOOLS.

9-58

LET EF FURNACES take care of your WIRE PROCESSING requirements

Designed to meet your specific requirements, and incorporating the most advanced heating practices, EF furnaces assure high heating efficiency, accurate automatically controlled cycles, minimum maintenance, continuous trouble-free operation and high hourly outputs. The uniformity of heat treatment reduces the cost of subsequent forming, fabricating and finishing operations, further cutting production costs.

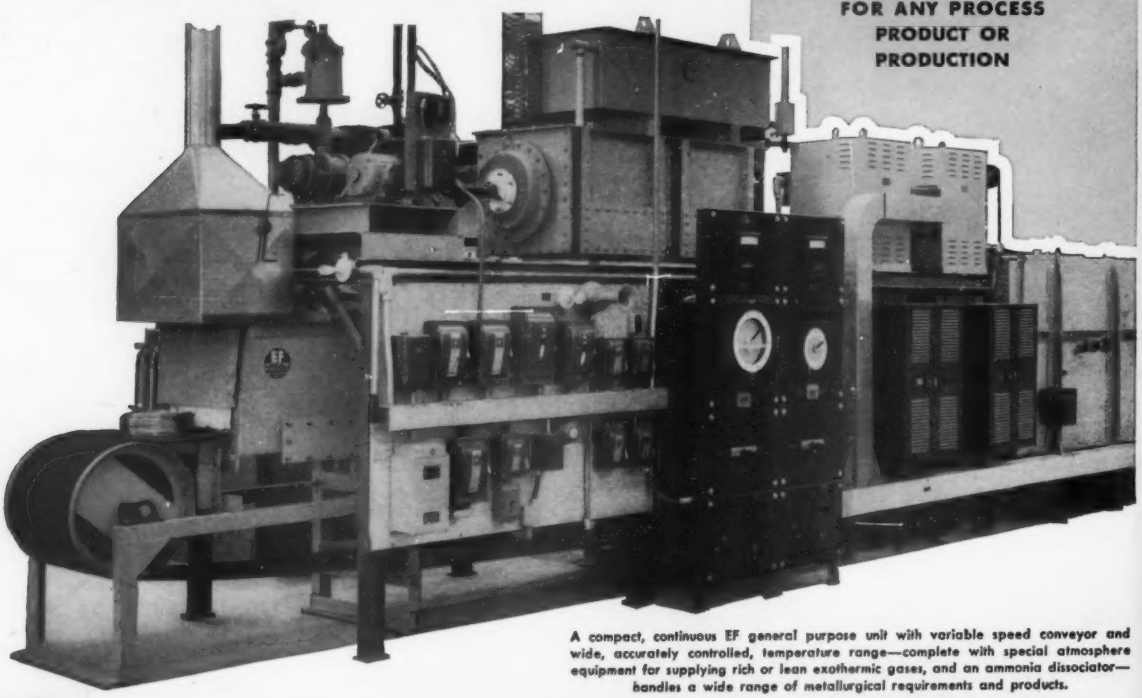
Built in continuous and batch types including roller hearth, roller rail, chain belt, wire belt, slot and tube conveyor, reciprocating, rotary, car, bell, pit and other designs for any ferrous or non-ferrous heating or heat treating process. Furnished complete with special atmosphere producers and any material handling equipment required. For utmost satisfaction — and economy — submit your furnace problems to experienced EF engineers, — *You'll find it pays.*

EF

GAS-FIRED OIL-FIRED AND ELECTRIC FURNACES *for*

- AGING
- ANNEALING
- BRAZING
- BILLET HEATING
- CARBON RESTORATION
- CARBURIZING
- CARBONITRIDING
- DRAWING
- GALVANIZING AND ALUMINIZING STRIP
- HARDENING
- HOMOGENIZING
- MALLEABLIZING
- NORMALIZING
- NITRIDING
- SINTERING
- SOLUTION TREATING
- SPECIAL ATMOSPHERE TREATMENTS
- STRESS RELIEVING

A SIZE AND TYPE FOR ANY PROCESS PRODUCT OR PRODUCTION



A compact, continuous EF general purpose unit with variable speed conveyor and wide, accurately controlled, temperature range—complete with special atmosphere equipment for supplying rich or lean exothermic gases, and an ammonia dissociator—handles a wide range of metallurgical requirements and products.

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